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Grass Silage Demonstrations, 1939-41—A Full Diet for Farm Stock—Allotments—Barley—Report of the Seed Propagation Division, 1942—Characteristics of Some Irish Orchard Soils in Relation to Apple Tree Growth—Sugar Beet Growing—Notes on Apple Scab in 1942—Soil Fertility and Crop Rotation—Fruit Crop Report, 1942—Compost—The Efficiency of Spray Treatment as a Remedy for Boron Deficiency in Sugar Beet and Swedes and for Manganese Deficiency in Oats—Diseased Conditions in Potatoes and Peas Associated With Potash Deficiency in South Kildare—Report on the National Egg-Laying Test, 1941-'42—Notes on the Emergency Powers (No. 234) Order, 1942, Relative to Cultivation of Land in 1943—Acreage under Crops and Pasture and Numbers of Livestock on 1st June, 1942—Insect Pests Affecting Food Production in Garden and Allotment—Making and Breaking Pastures.

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GRASS SILAGE DEMONSTRATIONS 1939—1941

The art of silage making was introduced from the Continent into Britain and thence into this country about the late seventies of the last century. It would scarcely be safe to contend that never before that time had anything approximating to silage been made intentionally or otherwise in the country. At the period mentioned, however, it was looked upon as a new process in agriculture and was taken up enthusiastically by a number of estate owners and large farmers. Considerable attention was devoted to it in the agricultural periodicals of the day and in 1885 a committee of the House of Commons, which included a number of Irish landholders was appointed to enquire into and report on its commendability as a farming process.

For many years after its introduction, silage making appears to have been looked upon rather as an alternative to hay making in wet seasons, than as a process for preserving summer herbage for winter feeding worthy of adoption on its own merits irrespective of weather considerations. It was resorted to only when the difficulty of saving a crop as hay actually presented itself. The result was, of course, often the production of a feeding stuff of indifferent feeding value and poor palatability. As a consequence when the first enthusiasm calmed down, comparatively little interest was shown in the process for a number of years.

About the time of its introduction into this country a somewhat similar wave of enthusiasm in regard to silage was passing over the U.S.A. There, however, the endeavour was to conserve green maize to provide succulent food for winter feeding. Maize silage proved such a valuable substitute for root crops, the cultivation, harvesting and storage of which entailed very considerable expenditure in labour, that the practice quickly became established throughout the United States and Canada.

It is of interest to note that in the first silage feeding experiment conducted by the Department of Agriculture in this country the crop ensiled was maize. This experiment was carried out in the spring of 1912 and continued the following year on the farm of Colonel Loftus Bryan, Enniscorthy, who had grown and ensiled the maize and asked the Department to investigate its feeding value. The value of silage as compared with that of roots in the ration of fattening cattle was then investigated. All the foods were analysed and fed on a dry matter basis and it was found that on this basis silage could adequately replace roots.

Apart from isolated cases, such as the above, the crop generally used for the making of silage in this country for many years after the introduction of the process was grass which had reached the stage at which it is usually cut for hay.

From about 1917 to 1926 the cost of producing root crops was such as to

render them an uneconomic proposition and during the earlier part of this period experimental work in silage making was devoted to the production and ensiling of mixed crops of cereals and legumes mainly with the object of replacing roots.

Various circumstances in the three or four years prior to 1926 led to attention in this country becoming directed once again to grass silage. A considerable area of land which had been under cultivation during the war years 1914-18 had been laid down again to grass. The productivity of grass land had been considerably increased, mainly by the use of phosphatic manures and also by better management. It was obvious that if the surplus grass produced in summer could be preserved in a palatable, succulent and easily digestible condition for winter feeding, stock feeders would benefit very considerably.

The most outstanding single event, however, which directed attention to the question of conserving young grass for winter feeding was the discovery by Professor Wood working at Cambridge, that grass in the early stages of growth may contain up to 30 per cent. of protein calculated on the dry matter. This knowledge, together with the results of Professor Woodman's subsequent researches gave particular incentive to the efforts to discover a practical and feasible method of preserving this high nutritive value for winter use. While in England the possibility of grass conservation by artificial drying was investigated, the efforts in this country were mainly directed to solving the problem by the process of ensiling, and experimental work in this connection was begun on the Department's farms about 1928.

The principal matters investigated in these experiments were :—

(1) Silage making from young grass versus haymaking.
(2) The comparative feeding value of silage made from young grass.
(3) The most convenient type of silo suitable for ensiling young grass and adaptable to ordinary farm conditions in the country.

Experiments on an elaborate scale were conducted during the same period by Professor Drew at the Albert Agricultural College, Dublin, and later by Professor Boyle at University College farm, Cork. The results reflected so favourably on grass silage that the Department considered it advisable to make a special endeavour to popularise the making of grass silage throughout the country. The matter was placed before the County Committees of Agriculture who were informed that the Department would approve of a scheme to subsidise the erection of four silos at the rate of £10 per silo in each Agricultural Instructor's district. The scheme was adopted by all counties except Donegal, Meath and Westmeath and under it 98 rectangular concrete silos were erected and ready for filling in 1932.

This scheme was continued in 1933 in slightly modified form. The construction of small, circular, reinforced concrete silos, using blocks, (instead of mass concrete as had hitherto been the practice in constructing silos) had been investigated by Professor Drew at the Albert College in 1932. This method of

construction proved so advantageous that circular block silos were recommended in 1933, and County Committees were authorised to provide moulds for issue on loan to farmers for making the blocks for the construction of silos.

The total number of silos erected under subsidy in the years 1932-33 was 173. The number of these filled in the years 1933 to 1939 was as follows :—

YEAR	1933	1934	1935	1936	1937	1938	1939
Silos filled	156	122	82	64	53	55	46

Despite the discouraging results from these efforts to extend silage making, and in view of the necessity of reducing our dependence on imported feeding stuffs the Department, convinced of the benefit it would be to the dairying industry if farmers in purely dairying areas could be induced to make silage of their surplus summer grass, decided in 1938 to institute further demonstrations in silage making in such areas. Funds were made available in 1939 for the subsidising, to the extent of £15 each, of 30 silos in essentially dairying districts. It was considered that the demonstrations might be rendered more effective if a number of these silos were erected reasonably close together in a limited number of areas. Six silos therefore, were allotted to each of the following districts, Cork N., Cork N.E., Limerick E., Limerick W., and Tipperary S. The Agricultural Instructors in these areas were asked to select six suitable farmers who would be prepared to erect silos under the conditions of the scheme : the selected farmers, so far as possible in each district, should be situated within easy reach of each other.

As a number of farmers throughout the country had for some years been treating their grass with molasses when filling the silos, with satisfactory results, and in view of the publicity which the making of silage from grass treated with mineral acids had been receiving, it was decided that in each district demonstrations should be provided in the making of grass silage by three methods (1) ordinary fermentation, (2) A.I.V. or mineral acid treatment and (3) treatment with molasses. Furthermore it was decided that at each of the five centres, two farmers would make silage by each of the three methods alternating the method for three successive seasons so that at the end of three years each of the thirty farmers would have made silage by each method and would in consequence be in a position to give a practical opinion on the merits of the different treatments.

Concrete circular silos about 16 feet in diameter and from 9 to 12 feet in height were constructed on the thirty selected farms and a suitable area of grassland on each farm was manured to produce early growth. Supplies of molasses and of A.I.V. solution sufficient to treat two silos by each method in each district were provided free of cost. The silos were filled under the supervision of the Agricultural Instructor for the district or of an official of the De-

partment, every possible care being given to ensure that satisfactory results would be obtained.

The following list gives the names and addresses of the farmers who erected the silos. In Tables I to VI which contain detailed particulars in connection with the erection, filling, etc., the silos are referred to by numbers corresponding to those in the list of names and addresses of the farmers.

No. of Silo	OWNER
1	James O'Donoghue, Gurteenaboul, Mitchelstown, Co. Cork.
2	Ml. Flynn, Carrigane, Mitchelstown, Co. Cork.
3	Joseph O'Donoghue, Pollardstown, Mitchelstown, Co. Cork.
4	R. Keilly, Kilglass, Mitchelstown, Co. Cork.
5	Ml. Casey, Gurteenaboul, Mitchelstown, Co. Cork.
6	Wm. Flynn, Carrigane, Mitchelstown, Co. Cork.
7	Ed. Hooper, Ardglass, Charleville, Co. Cork.
8	T. McAuliffe, Coarless, Charleville, Co. Cork.
9	C. O'Callaghan, Pruntus, Charleville, Co. Cork.
10	P. Carroll, BallydaLeen, Charleville, Co. Cork.
11	E. A. Browne, Walshestown, Charleville, Co. Cork.
12	J. S. Browne, Ballypierce, Charleville, Co. Cork.
13	P. O'Donnell, Nodstown, Cashel, Co. Tipperary.
14	M. Crowe, Slatefield, Cashel, Co. Tipperary.
15	Jas. Hickey, Kilbreedy, Cashel, Co. Tipperary.
16	T. Kevin, Nodstown, Cashel, Co. Tipperary.
17	Mrs. McKeogh, Nodstown, Cashel, Co. Tipperary.
18	T. Leahy, Toberadora, Thurles, Co. Tipperary.
19	Alex Gow, Glenstall, Murroe, Co. Limerick.
20	P. O'Donnell, Kilbreedy W., Kilmallock, Co. Limerick.
21	Harry Wheeler, Bruff, Co. Limerick.
22	Terence O'Brien, Derrybeg, Lisnalty, Co. Limerick.
23	John Daly, Ballylanders, Co. Limerick.
24	T. McNamara, Tobbenrea, Kilfinane, Co. Limerick.
25	T. Houlihan, Monavaha, Shanagolden, Co. Limerick.
26	Mrs. Mullins, Old Abbey, Shanagolden, Co. Limerick.
27	T. Lyons, Kilcolman, Co. Limerick.
28	W. Cremins, Ballykiely, Ardagh, Co. Limerick.
29	P. Madigan, Shrulaun, Shanagolden, Co. Limerick.
30	J. O'Connor, Shrulaun, Shanagolden, Co. Limerick.

TABLE I

Silo No.	Hours Work erecting Silo: Men	Hours Work erecting Silo: Horses	Hours Work filling Silo: Men	Hours Work filling Silo: Horses	Height of Silo	Type of Silo	Manure applied to grass per acre	Nature of Stuff at filling	Date of filling	Weather at filling	Weight of grass put into silo, Tons	Yield of grass per acre, Tons	Temperature developed in silo during filling, D. F.
1	[illegible]	13	140	48	9 ft.	A.I.V.	5 cwt. P.S. 1 cwt. S.A.	Soft and leafy, early grasses in flower	9-10 June	[illegible]	13	[illegible]	[illegible]
2	388	21	156	100	12 ft.	A.I.V.	6 cwt. Sem. & [illegible]	do.	16-20 "	Showers	[illegible]	[illegible]	70°
3	328	32	[illegible]	94	9 ft.	Molassed	1 cwt. [illegible]	Ryegrass-clover aftermath, rather coarse.	7-11 Aug.	[illegible]	[illegible]	7	[illegible]
4	260	(Motor lorry)	130	69	9 ft.	Molassed	Dung & 3 cwt. [illegible]	Fair sole, early grasses in flower	7-6 June	[illegible]	[illegible]	1½	[illegible]
5	353	51	130	83	9 ft.	Ordinary	10 cwt. P.S. 1 cwt. S.A.	Soft and luscious grasses	2-6 "	Dry, warm	—	—	1.5°
6	384	142	130	[illegible]	12 ft.	do.	Dung & 3 cwt. [illegible]	Soft, heavy crop of ryegrass in flower	9-10 "	[illegible]	30	10	[illegible]
7	216	(Motor lorry)	128	72	9 ft.	A.I.V.	6 cwt. Sem. & K. 1 cwt. S.A.	Soft and leafy, early grasses in flower.	9-12 "	[illegible]	20	[illegible]	[illegible]
8	[illegible]	24	151	68	9 ft.	A.I.V.	5 cwt. Super 1½ cwt. S.A.	Light rather stemmy; most grasses in flower	9-14 "	[illegible]	[illegible]	[illegible]	[illegible]
9	324	72	162	[illegible]	9 ft.	[illegible]	[illegible]	Stemmy fair sole, most grasses in flower.	12-15 "	[illegible]	23	[illegible]	[illegible]
10	50[illegible]	25	153	69	9 ft.	do.	[illegible]	Soft, leafy, large proportion of [illegible] foxtail in flower	26-29 May	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	19	7[illegible]	52	9 ft.	Ordinary	[illegible]	[illegible] rather [illegible]	10-12 June	[illegible]	17	[illegible]	[illegible]
12	301	33	17[illegible]	75	9 ft.	do.	[illegible] cwt. mixed artificials	[illegible]	10-1[illegible]	[illegible]	1		[illegible]
13	239	2[illegible]	14[illegible]	92	9 ft.	A.I.V.	1 cwt. Nitro [illegible]	[illegible] meadow-sweet [illegible]	12-1[illegible] June	[illegible]	20	[illegible]	[illegible]
14	224	24	140	[illegible]	9 ft.	A.I.V.	[illegible]	[illegible], early grasses in flower	[illegible]	[illegible]			[illegible]
15	30[illegible]	18	11[illegible]	74	[illegible] ft.	Molassed	[illegible]	[illegible]	10-14	[illegible]	[illegible]		
16	40[illegible]	40	1[illegible]1	120	9 ft.	do.	1 cwt. Nitro [illegible]	[illegible] large proportion of sedges and [illegible]	7-10 "	[illegible]	—	[illegible]	110°
17	248	30	125	64	9 ft.	Ordinary	[illegible] cwt. P.S.	Soft, leafy, early grasses in flower.	7-12 June	[illegible]	[illegible]	7½	[illegible]
18	178	34	123	77	9 ft.	Ordinary	1 cwt. Nitro-Chalk	do	12-16	Showers	[illegible]	7½	[illegible]
19	200	24	107	52	12 ft.	A.I.V.	None	Stemmy; fair sole, most grasses in flower.	9-10	Dry, warm	20	4	1[illegible]°
20	272	(Motor lorry)	149	57	10½ ft.	A.I.V.	Irrigation	Soft and leafy, meadow foxtail in flower	30-31 May	Dry, [illegible]	[illegible]	5	[illegible]
21	239	48	144	44	9 ft.	Molassed	Dung	[illegible] sole; [illegible] grasses in flower.	1-5 June	Dry, warm	22	3½	122°
22	178	(Motor lorry)	76	42	9 ft.	do.	3 cwt. Super. ½ cwt. S.A.	Soft and clovery	6-7 "	Dry-warm	17	4½	[illegible]
23	240	(Motor lorry)	169	42	9 ft.	Ordinary	4 cwt. P.S.	[illegible] wet meadow herbage.	22-23 June	Cloudy, showers	25	7	[illegible]
24	216	48	130	70	9 ft.	do.	None	Good sole, early grasses in flower	1[illegible]-14 "	Cool, cloudy	[illegible]	[illegible]	[illegible]
25	228	24	106	95	10½ ft.	A.I.V.	4 cwt. Super 1 cwt. S.A.	Light [illegible] grasses in flower	26-31 May	Warm, dry	27	3½	[illegible]
26	219	16	112	85	9 ft.	do.	4 cwt. Super 1 cwt. S.A.	Ryegrass & clover aftermath rather coarse.	12-14 Sep.	Cool, dry	11	2½	97°
27	224	32	160	64	9 ft	Molassed	Irrigation	Soft, leafy, meadow foxtail in flower	19-22 May	Warm, dry	20	4½	[illegible]
28	230	16	270	110	12 ft.	do.	1 cwt. S.A	Old meadow aftergrass soft and leafy.	11-14 Sep	Mild, dry	33	4	[illegible]
29	224	24	180	49	9 ft.	Ordinary	1 cwt. N Soda	Thick sole of grass & clover.	4-7 Aug	Mild, dry	23	5	[illegible]
30	240	32	9[illegible]	40	9 ft.	do	4 cwt. Super 1½ cwt. S.A.	Good sole; most grasses in flower	19-20 June	Hot, dry	13	[illegible]	120

K. = Kainit; P.S. = Potassic super; S.A. = Sulphate of Ammonia; Sem. = Semsol.

partment, every possible care being given to ensure that satisfactory results would be obtained.

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Table I contains particulars of labour involved in constructing and filling the silos as well as of manures applied to the land, nature and stage of growth of herbage at time of cutting, date of filling, yield of crop, weight put into each silo and the temperature developed.

In nearly all cases the entire work of erecting the silos was done by farm labour. Twenty-nine of the thirty silos were constructed of concrete blocks made in metal moulds specially designed for this type of silo. In one case (silo No. 6) the silo was constructed in mass concrete and a tradesman was employed to assist in the work. In four cases the silos were 12 feet high and in two cases 10½ feet high. In the remaining twenty-four cases the height was 9 feet. The diameter in 29 cases was 16 feet. In the case of silo No. 1 the diameter was 17½ feet. The average man labour involved in the construction was 285 hours and 36 hours of horse labour. These times include carting of materials, excavation of the site and all work connected with the erection. In the case of five silos the cartage of materials was done by motor lorry and the time is not recorded for the operation.

The weather for many weeks before filling had in the most districts been almost rainless so that the growth of grass was much below normal and in many cases necessitated the postponement of cutting until the crop had reached a more advanced stage than is desirable for highest quality silage. During filling extremely warm weather was experienced at many centres so that even when filling was continued each day the temperature developed overnight was somewhat high. In some cases the shade temperature (and the temperature of the grass at filling) was over 80 degrees F. The aim during filling was to allow the temperature to rise to at least 80 degrees F., except where the A.I.V. treatment was being used, when the filling was done as quickly as possible in order to keep the temperature low. The temperatures recorded in the tables were in all cases measured at 18 inches to 2 feet below the surface.

The A.I.V. solution was prepared and supplied by Imperial Chemical Industries, Ltd., who obtained from the patentees in Finland permission to use the process. The dilution was 1 part of concentrated acid to 6 parts of water and the rate of application was 14 gallons of the dilute solution per ton of grass. The solution was applied with watering cans treated with acid-resisting paint. The average cost of the acid to the farmer's nearest railway station worked out at 1/6 per gallon or 3/- per ton of grass.

The molasses was diluted with water at the rate of 1 part molasses to 3 parts water and the dilute solution applied at the rate of 8 gallons per ton of grass. The average cost of the molasses to the farmer's nearest railway station was 1/- per gallon or 2/- per ton of grass.

Filling of the first silo commenced on the 19th May. In all cases the silos were filled as quickly as possible consistent with the required rise in temperature. Immediately filling was complete a layer of earth 18 inches deep was placed on top of the grass and when settling had ceased, the silo roof put on.

The average time taken in the filling per ton of grass put into the silo for all 30 silos was 7 hours man labour and 3.4 hours horse labour. These figures cover all operations in connection with the work, but in considering them it is well to remember that none of those engaged in the work had any previous experience of silage making.

The silos were opened from the middle of January, 1940, onward, the silage being used mainly for the feeding of dairy cows.

The following is a report on the condition of the silage in each silo at opening.

No. of Silo	Type of silage	AMOUNT OF WASTE OR MOULD AND QUALITY OF SILAGE.
1	A.I.V.	Layer 1 inch deep on top, increasing to 4 inches deep at wall mouldy. Quality of silage excellent.
2	do.	Layer 6 inches deep on top, increasing to 12 inches deep at wall mouldy. Quality of silage good.
3	Molassed	Layer 5 inches deep on top, increasing to 12 inches deep at wall mouldy. Quality of silage very good.
4	do.	Layer 1 to 2 inches deep on top, increasing to 12 inches deep at wall mouldy. Quality of silage very good.
5	Ordinary	Layer 4 inches deep on top, increasing to 15 inches deep at wall mouldy. Quality of silage very good.
6	do.	Layer 1 inch deep or less waste on top. A small amount of waste around door. Quality of silage excellent.
7	A.I.V.	Layer 1 to 2 inches mouldy on top. Quality of silage very good.
8	do.	Layer 9 inches deep on top, increasing to 18 inches deep at wall mouldy. Quality of silage fair.
9	Molassed	Layer 6 inches deep (3 inches roughage) mould on top 1 foot inwards and 2 feet deep at door mouldy. Quality of silage very good.
10	do.	Layer 1 to 2 inches waste on top and a little around door. Quality of silage very good.
11	Ordinary	Layer 6 inches deep on top, increasing to 18 inches deep at wall waste and mouldy. Quality of silage very good.
12	Ordinary	Layer 6 inches on top, increasing to 15 inches deep at wall mouldy or waste. An area of waste extending 6 feet along wall 2 feet deep and 1½ feet inward. Quality of silage good.
13	A.I.V.	Layer 8 to 9 inches deep on top, increasing to 18 inches deep at wall mouldy. Quality of silage good.
14	do.	Layer 6 to 8 inches deep on top, increasing to 15 inches deep at wall mouldy. Quality of silage excellent.
15	Molassed	Layer 3 to 4 inches deep on top, increasing to 15 inches deep at wall mouldy. Quality of silage excellent.
16	do.	Layer 3 to 4 inches deep on top increasing to 18 inches deep at wall mouldy. Quality of silage very good.

TABLE III.

Silo No.	Hours Work filling Silo: Men	Hours Work filling Silo: Horse	Type of Silage	Manure applied per acre	Nature of Herbage at filling	Date of filling	Weather at filling	Weight of grass put into silo. Tons	Yield of grass per acre. Tons	Temperature developed in silo at filling Deg. F.
1	130	80	Ordinary	5 cwt. P.S.	Soft, luxuriant, ryegrass & clover.	27-30 May	Dry, cool	38	11	85°
2	208	120	"	1 cwt. S.A. 1 " P.S. 5 " Super	Soft luxuriant; early grasses in flower.	6-12 June	Dry, very warm	33	[illegible]	110°
3	126	92	A.I.V.	2 cwt. Nitrate of Soda.	Aftermath clover and rye-grass in flower.	30 July—1 August	Dry and warm	31	5½	95°
4	163	85	A.I.V.	4 cwt. S.A. 1 " P.S. 2 " Super	Short, thick, leafy, sole, some grasses in flower.	27-28 May	Dry, cool	23	6½	[illegible]
5	141	94	Molassed	1½ cwt. S.A. 1½ cwt. P.S.	Moderately thick sole, early grasses in flower	29-31 May	Dry, moderate heat	26	8	100°
6	208	108	"	Dung and liquid manure.	Soft, luxuriant; early grasses in flower	29 May—7 June	Mainly dry, moderate	60	9½	100°
7	118	62	Ordinary	5 cwt. P.S. 1 cwt. S.A.	Thick sole, early grasses in flower	13-15 June	Dry, warm	25	8½	105°
8	116	47	Molassed	4 cwt. Super 1 " S.A.	Heavy soft grass, little in flower	30 May—1 June	Dry, warm	2[illegible]	8	85°
9	181	100	Ordinary	Farmyard dung 1 cwt. S.A.	Fair sole; most grasses in flower.	4-7 June	Dry, warm	20½	5½	100°
10	133	59	A.I.V.	1 cwt. S.A.	Good sole, early grasses in flower	26-28 May	Showery	26	7½	85°
11	120	70	A.I.V.	2 cwt. Super	Thick soft leafy sole.	1-6 June	Dry, warm	23	5½	125°
12	111	45	Molassed	1 cwt. S.A.	Good sole early grasses in flower.	8-9 June	Dry, warm	20½	6½	75°
13	98	45	Ordinary	1 cwt. Nitro-Chalk	Grass, fine sedge & meadow sweet; from flooded meadow.	6-10 June	Dry, warm	26	5½	
14	113	32	Molassed	None	Heavy aftermath clover & ryegrass in flower.	4-8 Aug.	Dry, warm	30	[illegible]	
15	93	46	Ordinary	4 cwt. P.S. 1 " S.A.	Rather stemmy; fair sole, most [illegible]	12-15 June	Dry, [illegible]	[illegible]	7	
16	108	66	A.I.V.	1 cwt. S.A.	Soft, leafy sole, grasses beginning to flower.	30 May—3 June	Mainly dry and cool	24	7	
17	115	49	A.I.V.	1 cwt. S.A.	Heavy, leafy, sole, early grasses in flower.	4-6 June	Dry and warm	33	10	
18	128	42	Molassed	None.	Grass and fine sedge from flooded meadow.	5-8 June	Dry and warm	32	6½	
19	200	78	Ordinary	None.	Fair sole, early grasses in flower	1-6 June	Dry, warm	45	6	
20	124	42	Ordinary	Irrigated, and liquid manure.	Rich luxuriant, leafy herbage	18-21 May	Fine, cool	25	12	104°
21	132	36	A.I.V.	10 tons farmyard.	Rich luxuriant, early grasses in flower.	23-25 May	Fine, cool	25	7½	90°
22	121	42	A.I.V.	3 cwt. super 1 cwt. S.A.	Light bottom, stemmy, most grasses in flower.	4-6 June	Dry, warm	26	7	100°
23	130	41	Molassed	Part 10 tons Dung. Part 3 cwt. Super 1 cwt. S.A.	Soft succulent grass and clover mixture, early grasses in flower	11-12 June	Dry, warm	27	9	95°
24	120	40	Molassed	10 tons Dung.	Good mixture and clover early grasses in flower	28-29 May	Dry, cool	25	9	90°
25	140	60	Molassed	Part 10 tons Dung Part 4 cwt. Super Part 1 cwt. S.A.	Thick short sole of leafy herbage	27 May—1 June	Very warm and dry	26	6½	105°
26	125	56	Molassed	Irrigation	Rather stemmy, early grasses in flower	27 May—1 June	do.	22	7	115°
27	160	64	Ordinary	Irrigation	Soft heavy crop early grasses in flower.	25-31 May	do.	20	9	120°
28	205	98	Ordinary	4 cwt. Super 1 " S.A.	Thick sole, leafy herbage.	28 May—4 June	do.	35	7	90°
29	112	42	A.I.V.	do.	Fair bottom, most grasses in flower.	6-8 June	do.	19	6½	105°
30	105	35	do.	do.	Fairly good leafy sole.	5-7 June	do.	16	7½	100°

PS. — Potassic Super. S.A. — Sulphate of Ammonia

No. of Silo	Type of silage	AMOUNT OF WASTE OR MOULD AND QUALITY OF SILAGE.
17	Ordinary	Layer 2 inches deep on top, increasing to 9 inches deep at wall mouldy. Quality of silage excellent.
18	do.	Layer 9 inches deep on top (including roughage), increasing to 18 inches deep at wall mouldy. Quality of silage excellent.
19	A.I.V.	Layer 9 to 10 inches on top mouldy. Quality of silage very good.
20	do.	Layer 5 inches deep on top, increasing to 18 inches deep at wall mouldy. Quality of silage very good.
21	Molassed	Layer 4 inches deep on top, increasing to 12 inches deep at wall mouldy. Quality of silage very good.
22	do.	Layer 2 to 3 inches deep on top, increasing to 12 inches deep at wall mouldy. Quality of silage very good.
23	Ordinary	Layer 6 to 7 inches deep on top, increasing to 9 inches deep at wall mouldy or waste. Quality of silage good.
24	do.	Layer 1 to 2 inches deep on top, increasing to 15 inches deep at wall mouldy. Quality of silage very good.
25	A.I.V.	Layer 6 to 9 inches deep on top, increasing to 18 inches deep at wall mouldy. Quality of silage very good.
26	do.	Layer 6 to 9 inches deep on top mouldy. Some waste around door. Some mould patches in ryegrass in lower part of silo. Quality of silage fair.
27	Molassed	Layer 2 inches deep on top, increasing to 9 inches deep at wall mouldy. Quality of silage very good.
28	do.	Layer 2 inches deep roughage on top waste. A little mould around wall at top. Quality of silage excellent.
29	Ordinary	A little waste at door. Quality of silage very good.
30	do.	Layer 3 inches deep on top, increasing to 12 inches deep at wall mouldy. Some mould and waste at door. Quality of silage very good.

The silage in all cases, even in three cases where the herbage consisted larg[illegible] of meadow sweet and sedges was perfectly cured. In no case was there the slightest sign of the silage having settled away from the silo wall and in only one case did the mould at the wall go down more than 2 feet. In this case the badly moulded area involved only a small proportion of the circumference of the silage heap.

In a considerable number of cases the amount of mould on the top was

greater in the case of the A.I.V. silage than in the case of either the ordinary or molassed silage.

In order to give farmers in the neighbourhood of the districts in which the silos were situated an opportunity of examining the silos and the silage made by the different processes, demonstrations, including lectures, were arranged in each district on a date shortly after the owners had begun to use the silage. These demonstrations were suitably advertised in the press, by posters and by special invitations sent through the post.

Samples of the silage from all thirty silos were tested for pH value. The samples, which consisted of a block of silage taken from as near the centre of the silo as possible in each case, were placed in 5 biscuit tins, sealed and despatched directly to the Albert Agricultural College where the pH was determined as soon as possible after reception. The pH values are given in Table II.

TABLE II.

No. of Silo	Type of Silage	pH	No. of Silo	Type of Silage	pH	No. of Silo	Type of Silage	pH
1	A.I.V.	4.1	3	Molassed	4.4	5	Ordinary	4.6
2	,,	4.6	4	,,	4.4	6	,,	4.6
7	,,	4.6	9	,,	4.3	11	,,	4.3
8	,,	4.3	10	,,	4.5	12	,,	4.4
13	,,	3.5	15	,,	4.8	17	,,	4.4
14	,,	4.5	16	,,	4.9	18	,,	4.9
19	,,	2.8	21	,,	4.3	23	,,	4.2
20	,,	3.8	22	,,	4.6	24	,,	4.4
25	,,	4.3	27	,,	4.3	29	,,	4.6
26	,,	3.6	28	,,	4.3	30	,,	4.6

In none of the samples of A.I.V. silage did the pH reach 4.8, the point below which butyric acid fermentation is considered to be impossible. One sample each of the molassed and ordinary silage samples gave a pH value of 4.9, these being the highest in all 30 samples. From the point of view of development of acidity, therefore, the silage at all 30 centres proved entirely satisfactory.

SEASON 1940.

The thirty demonstration silos described in the foregoing were again filled in 1940. Twenty eight were filled with first cut meadow grass and the remaining two with clover-ryegrass aftermath. The weather during late spring and early summer was much more conducive to heavy crops of grass than in the previous

season so that yields generally were considerably higher. In many cases filling was begun a week to ten days earlier than in 1939. Filling of the first silo was begun on 18th May. The softer and more luscious grass packed more closely in the silos so that in most cases the weight of material required to fill the silo showed an increase over that of the previous year. That this increase was not due to any extent to a greater proportion of adhering moisture may be deduced from the weather report which indicates that at the time of filling of most of the silos the weather was dry and warm. In the case of silos Nos. 2, 6, and 19, however, the owners, convinced of the advantages of silage had increased the height of the silos by about 3 feet in each case. As in the previous season the silos were filled as quickly as possible consistent with proper temperature control and were finished off with 18 inches of earth and roofed.

Details of the labour involved in the filling of the silos, the type of silage, nature of herbage, manuring, date of filling and weather conditions during the operation, weight of grass put into the silos, yield per acre and temperature developed in the silos are given for each silo in table III. The average labour per ton of grass put into the silos was 4.7 hours manual and 2.1 hours horse labour.

Feeding of the silage in one case began early in October but in the majority of cases did not begin till spring. The following is a report on the condition of the silage in each silo at opening:

No. of Silo	Type of Silage	AMOUNT OF WASTE OR MOULD AND QUALITY OF SILAGE.
1	Ordinary	Layer 1½ inch deep on top mouldy, the mould going down 9 inches around wall. 4 cubic feet at door waste. Total waste equivalent to one to two per cent. of all the silage. Quality of silage excellent.
2	Ordinary	Same as No. 1.
3	A.I.V.	Layer 3 inches deep mouldy at top, the mould going down 6 inches at wall. 3 inch layer in middle of silo mouldy. Small patches of mould throughout upper half. 10 per cent. of silage moulded. Quality of silage, lower half very good, upper half fair.
4	A.I.V.	Layer 2 inches deep at top, increasing to 6 inches deep at wall mouldy. A small quantity of mould around door and some pockets of mould in upper half of silo. Total mouldy material not more than 5 per cent. of whole. Quality of silage very good.
5	Molassed	Layer 2 inches deep at top, increasing to 9 inches deep at wall mouldy. 6 cubic feet at door mouldy. Quality of silage good.
6	Molassed	Layer 1 inch deep at top, increasing to 9 inches deep at wall decayed, also 9 cubic feet at door. Quality of silage excellent.
7	Ordinary	Layer 3 inches deep at top, increasing to 14 inches deep at wall slightly mouldy. Quality of silage excellent.
8	Molassed	Layer 2 inches deep at top, increasing to 12 inches deep at wall morldy. Quality of silage very good.
9	Ordinary	No mould on top except in covering of wild iris. Shoulder about 18 inches deep at wall mouldy. Quality of silage good.
10	A.I.V.	No mould on top except in covering of wild iris. A shoulder 4 inches deep at wall mouldy. Quality of silage very good.
11	A.I.V.	No mould on top. A shoulder 18 inches deep at wall mouldy. Quality of silage very good.
12	Molassed	Layer 4 inches deep on top, increasing to 18 inches deep at wall mouldy. Small mouldy patches in top 1½ feet of silage. Quality of silage veiy good.
13	Ordinary	Layer 6 inches deep on top, increasing to 18 inches deep at wall waste. Quality of silage very good.
14	Molassed	Layer 6 inches deep on top, increasing to 15 inches deep at wall mouldy. Quality of silage very good.

No. of Silo	Type of Silage	AMOUNT OF WASTE OR MOULDED MATERIAL AND QUALITY OF SILAGE.
15	Ordinary	No waste or mould except in two loads of sedges put on top of grass at filling. Quality of silage very good.
16	A.I.V.	Layer 4 inches deep on top, increasing to 12 inches deep at wall mouldy. Quality of silage very good.
17	A.I.V.	Layer 6 inches deep on top, increasing to 18 inches deep at wall mouldy. Small patches of mould throughout silo. Quality of silage good. *NOTE.* Owing to pressure of other work on the farm filling of silo was postponed for a week or more after grass was ready; with the result that although a heavy crop it was rather stemmy for A.I.V. silage.
18	Molassed	No mould or waste. Quality of silage very good.
19	Ordinary	Layer 1½ inches deep on top mouldy. Quality of silage good.
20	Ordinary	Layer 1 inch deep on top mouldy. Quality of silage very good.
21	A.I.V.	Practically no mould. Quality of silage excellent.
22	A.I.V.	Layer 1 inch on top mouldy. Quality of silage very good.
23	Molassed	Layer 1 inch on top waste. Quality of silage very good.
24	Molassed	Layer 1½ inches deep on top waste. Quality of silage good.
25	Molassed	Practically no mould or waste. Quality of silage excellent.
26	Molassed	Small amount of waste on top. About 12 cubic feet waste at one point along wall where silage settled away from wall. Total waste about 10 per cent. Quality of silage fair.
27	Ordinary	Layer 1 inch deep on top mouldy, about 12 cubic feet waste at door. Quality of silage very good.
28	Ordinary	Practically no waste or mould. Quality of silage excellent.
29	A.I.V.	Small quantity of mould on top at wall and around door. Total waste about 2 per cent. of the whole. Quality of silage very good.
30	A.I.V.	Same as No. 29. Quality of silage good.

The silage was perfectly cured in all cases with the possible exception of No. 17 where small patches of mould developed throughout the mass. Only in the case of No. 26 was there any tendency for the silage to settle away from the wall of the silo and in this case only a small area was involved. In no case did the amount of mouldy or waste material exceed 10 per cent. of the total silage and in the majority of cases it was much below 5 per cent.

After the silos were opened demonstrations were given by the Agricultural Instructors in each of the five areas to which local farmers and others interested were invited.

Samples of the silage from 29 of the 30 centres were forwarded to the Albert Agricultural College where the pH was determined. The results are contained in Table IV.

TABLE IV.

No. of Silo	Type of Silage	pH	No. of Silo	Type of Silage	pH	No. of Silo	Type of Silage	pH
3	A.I.V.	4.3	5	Molassed	5.2	1	Ordinary	4.6
4	,,	4.0	6	,,	4.4	2	,,	4.4
10	,,	3.9	8	,,	4.2	7	,,	4.8
11	,,	4.1	12	,,	4.5	9	,,	4.7
16	,,	4.1	14	,,	4.6	13	,,	4.4
17	,,	4.8	18	,,	4.5	15	,,	4.6
21	,,	3.2	23	,,	4.1	19	,,	—
22	,,	3.2	24	,,	3.9	20	,,	5.0
29	,,	3.8	25	,,	4.4	27	,,	4.3
30	,,	4.3	26	,,	4.3	28	,,	4.9

In the A.I.V. silage the pH in one case only, reached 4.8, the point below which butyric acid development is considered unlikely to take place. In the case of the molassed silage this figure was exceeded at one centre and in the ordinary silage at two centres. With these three exceptions the pH values are entirely satisfactory.

SEASON 1941.

It was unfortunately impossible to obtain supplies of A.I.V. solution for the 1941 season. Consequently the ten farmers who should have treated their silage according to this process had to adopt the ordinary process. The ten who had not in either of the two previous years made molassed silage were supplied with molasses for the purpose.

Having convinced themselves of the value of silage over two seasons the owners of silos Nos. 1, 7, 16 and 25 increased the height of their silos while the owner of silo No. 21 erected a second silo.

Manures for grassland were difficult to obtain so that in some cases the quantity applied was below normal while in a few none could be procured. Despite this and a rather dry spring, crops of grass for silage were, in practically all cases, most satisfactory.

Filling began on 30th May and the majority of the silos were filled during the following three weeks. Details of labour, type of silage, nature of herbage, manuring date of and weather conditions during filling, weight of grass put into the silos, yield per acre and temperatures developed in the silos are given for each silo in Table V.

The average labour per ton of grass put into the silo (for all 30 silos) was 4 hours manual and just under 2 hours horse labour.

The following is a report on the condition of the silage in each silo at opening the following winter or early spring.

No. of Silo	Type of Silage	AMOUNT OF WASTE OR MOULDED MATERIAL OF SILAGE.
1	Molassed	Layer 2 inches deep on top, shoulder 12 inches deep at wall waste. Total waste approximately 3 per cent. Quality of silage very good.
2	do.	Layer 1½ inches deep on top moulded. Quality of silage very good.
3	Ordinary	Layer 1½ inches deep on top moulded. Quality of silage excellent.
4	do.	Layer 1 inch deep on top moulded. Quality of silage good.
5	do.	Layer 3 inches deep on top waste. Quality of silage good.
6	do.	Layer 1½ inches deep on top waste. Quality of silage very good.
7	Molassed	Layer 1½ inches deep on top, deepening to 9 inches at wall mouldy. Quality of silage very good.
8	Ordinary	Layer 1 inch deep on top, deepening slightly at wall mouldy. Waste equivalent to 2 per cent. of total. Quality of silage good.
9	do.	Layer 2 inches deep on top, deepening slightly at wall waste. Quality of silage very good.
10	do.	Same as No. 7.
11	Molassed	Layer ½ inch deep on top, deepening slightly at wall mouldy. Small quantity of waste at door.
12	Ordinary	No waste on top except adjacent to wall where mould developed to a depth of 18 inches.
13	Molassed	Layer 3 inches deep on top, deepening slightly at wall mouldy. Quality of silage very good.
14	Ordinary	Same as No. 13. Quality of silage excellent.
15	do.	do. Quality of silage very good.
16	do.	do. do.
17	Molassed	Layer 2 inches deep on top, deepening slightly at wall mouldy. Quality of silage excellent.
18	Ordinary	Layer 3½ to 4 inches on top, deepening slightly at wall mouldy. Quality of silage very good.
19	Molassed	Layer 2 inches deep on top, deepening slightly at wall mouldy. Quality of silage excellent.
20	do.	No waste. Quality of silage excellent.

No. of Silo	Type of Silage	AMOUNT OF WASTE OR MOULD AND QUALITY OF SILAGE.
21	Ordinary	Slight discolouration under clay but all edible. Quality of silage excellent.
22	do.	Very slight amount of mould on top. Quality of silage excellent.
23	do.	do.
24	Ordinary	Layer 1 inch deep on top mouldy. Quality of silage very good.
25	do.	Layer 4 inches deep on top waste, also a little at door. Total waste less than 4 per cent. of silage. Quality very good.
26	do.	Layer 5 inches deep on top mouldy. Quality of silage fair. (Grass too advanced at filling).
27	do.	Layer 3 inches deep on top mouldy. Quality of silage excellent.
28	do.	Layer 2 inches deep on top waste. Quality of silage excellent.
29	Molassed	Layer 1 to 2 inches deep on top waste. Quality of silage very good. Temperature would seem to have been rather high as silage slightly brown in colour.
30	do.	Layer 6 inches deep on top mouldy. Quality of silage good.

As indicated by the report the amount of waste in practically every case was of negligible proportions. In the case of only one silo out of the thirty would it have exceeded 5 per cent. of the total bulk of silage.

As in the two previous seasons a sample from each silo was transmitted to Albert Agricultural College for pH test. The results are contained in Table VI.

TABLE VI.

No. of Silo	Type of Silage	pH	No. of Silo	Type of Silage	pH	No. of Silo	Type of Silage	pH
1	Molassed	4.9	3	Ordinary	4.7	16	Ordinary	5.3
2	,,	5.2	4	,,	5.0	18	,,	5.3
7	,,	5.2	5	,,	4.5	21	,,	5.4
8	,,	4.3	6	,,	5.4	22	,,	3.9
13	,,	4.8	9	,,	4.7	23	,,	5.4
17	,,	5.1	10	,,	5.2	24	,,	4.4
19	,,	4.3	11	,,	4.0	25	,,	5.2
20	,,	4.1	12	,,	5.0	26	,,	5.2
29	,,	4.5	14	,,	4.8	27	,,	5.5
30	,,	4.7	15	,,	5.0	28	,,	5.4

Judged according to accepted standards the pH value in many cases is unusually high. In 17 out of the 30 cases it is 4.9 or over and goes as high as 5.5 in the case of silo No. 27. As indicated, however, the amount of waste in the case of these silos was negligible. Curing of the herbage so far as could be judged from appearance and odour was perfect and the silage was relished by all stock and was fed with most satisfactory results. All the farmers concerned had already had two years experience of good silage and all were satisfied that the silage was at least as good as it had been in either of the two previous years. Although it has never been suggested that the pH value is an infallible guide to the quality of silage, the results obtained in 1941 tend to suggest that only a minimum of reliance can be placed on it.

As the main object of the work described in the foregoing was the popularising of silage making in the districts in which the thirty silos were erected the numbers of new silos constructed in the three subsequent years in these districts is an indication of the success of this work. The numbers are as follows :

	1940	1941	1942
County Cork, N.E.	6	8	8
,, ,, N.W.	14	5	16
,, Limerick	49	34	30
,, Tipperary S.	39	28	12

The figures indicate a slow but steady spread in silage making and while more rapid progress in this direction had been hoped for it is possible that the slow development was in reality an advantage. It enabled the Agricultural Instructors to supervise the filling of practically all silos in their areas thus ensuring that only good quality silage with a minimum of waste was produced. The results from feeding good silage are so obvious in the condition and health of cattle that in districts where summer dairying and stock farming predominate farmers who are not using silage soon realise that they are working at a disadvantage. This actually is what has occurred in the districts in which the demonstration silos were erected. Many farmers who have not yet made silage are fully convinced of its value. Scarcity of labour, preoccupation with increased tillage and the increase in cost of materials have prevented many farmers erecting silos, and in the circumstances the numbers which have been erected cannot be considered unsatisfactory.

Of the thirty farmers on whose farms the demonstration silos were erected, three constructed a second silo of similar type and size and one adapted an existing building to silage making ; six increased the size of their silos by building them higher and one constructed an ordinary pit silo. Considering that many of the farms on which these silos were erected were between 30 and 40 acres in size and therefore limited in the amount of grass that could be made available for silage the extensions indicate that the farmers are satisfied that silage is a valuable feeding stuff.

A FULL DIET FOR ALL FARM ANIMALS

Broadcast talk given by PROFESSOR E. J. SHEEHY, D.Sc., Head of Animal Nutrition Department, University College, Dublin,
on Saturday, 13th March, 1943.

About this time last year the supply of wheat in the country was so limited as to give rise to public concern. It looked as if we were not going to have enough wheat, and among other means of coping with the emergency a series of radio talks on methods of "meeting the wheat shortage in the home" was given from this station. Luckily, there was no shortage of human food, and with the full co-operation of all producers we hope to accumulate sufficient supplies this growing season to place us beyond the danger of starvation. The farm animal has fared worse. As soon as war conditions excluded foreign foods the pig population was faced with either short rations or reduction in numbers. The latter took place. Similarly, there was a reduction in the numbers of egg laying poultry. The cattle did not shrink in numbers, but inadequate feeding reduced the rate of output; milk and butter supplies fell.

A slight recovery in the matter of food for farm stock has taken place, but the continued shortage is indicated by the fact that farmers are at the moment producing insufficient pigs and milk to supply a full ration of bacon and butter to all our people. Three important items in the list of stock foods available in plentitude in 1939, namely, maize, mill offals, and oil cakes, are now unobtainable. Luckily, however, equally good substitutes can be produced here, and the problem of feeding farm animals has become one of increased production on the farm. If only we could produce more wheat the entire grain need not be absorbed into flour for bread, a proportion of the bran and pollard could be diverted to animal feeding while at the same time a whiter flour could be supplied to the baker. The only way in which to make available a whiter flour for the table and a proportion of wheat offals for animal feeding is to produce very much more wheat. The spring planting season is advancing. Farmers are exhorted to make a very special effort to sow a few extra acres in addition to what they have already arranged for. Oats, barley and potatoes take the place of the imported maize of pre-war days for all purposes for which maize was used. Oil cakes were favoured because of their richness in protein and their special effect in enhancing the remainder of the ration given to farm animals. For these purposes oil cakes, are, however, no better than young grass or green forage crops such as cabbage and kale, or good silage, all of which we can have in abundance by the exercise of a little forethought and the application of a little enterprise in producing them. Farm produced protein foods may be supplemented by meat meal, excellent samples of which are produced in several factories in the country.

Meat meal is freely obtainable and is an excellent food not alone for pigs and poultry but for cattle also.

We require this year, not alone an extension of wheat production, but also a much greater acreage of oats, barley, potatoes, roots and green foods, and farmers should not fail to ensile some summer green food for feeding in mid winter. A crop of silage cut from a grass field in June is scarcely missed because a thick sole of young grass provides good grazing a few weeks after the ensilage grass is removed. Cattle fed on good ensilage can have the meal ration either wholly or partially dispensed with, thereby increasing the quantity of meals at the disposal of pigs and poultry. There will be little use in advising next winter on the most economical methods of utilising certain foods if supplies are not forthcoming in the meantime: in present circumstances stock feeding is intimately bound up with cropping.

It takes about 9 cwts. of meal or the equivalent thereof to produce a 2 cwt. fat pig. At present prices of pork an all-meat diet does not leave much profit. A cheaper food must be used. The cheaper food is the potato because three times more nutrient material for pigs is forthcoming from an acre of potatoes than from an acre of corn. In order to get the most out of potatoes they must be cooked and fed fresh or else ensiled for feeding later on. Fattening pigs may have two thirds of their meal allowance replaced by potatoes. Thus, a pig which would normally consume 6 pounds of meal daily may be limited to 2½ pounds of meal the remaining 3½ pounds being replaced by potatoes of which the quantity necessary is 14 pounds. To enable a pig to consume a stone of potatoes each day feeding must be done several times, or alternatively the potatoes in the dry form i.e. as taken out of the boiler, must be before the pigs in the troughs at all times. For the guidance of those who give a wet mash and who wish to include the maximum of potatoes the proportion by weight of boiled potatoes and of meals for the respective ages is as follows:

10	weeks	old	pigs:	1	part	potatoes	to	1	part	meals
20	,,	,,	,,:	4		,,	,,	,,	,,	
26	,,	,,	,,:	8		,,	,,	,,	,,	

The feeding of potatoes may begin as soon as the bonhams start trough feeding, the proportion of tubers being gradually increased. Boiled cabbage or turnips may be used partly, to replace the potatoes without reducing appreciably the progress of the pigs. When considerable numbers of pigs are kept a method economical of time and labour is to keep the boiled potatoes in a suitable trough more or less continuously before the animals so that they may be consumed at will. In that case the appropriate daily quantity of meals, which may be fed dry, for each pig, need never exceed 2½ lb. per day.

Profitable poultry keeping demands that potatoes should also form a considerable part of the diet of fowl which relish them very much. The potatoes are usually mixed with the meal but. when it is desired to feed them extensively, a better method is to place the freshly boiled tubers in a trough and allow the fowl access to them ad lib. By restricting the daily meal allowance to chickens as well as adult fowl to $2\frac{1}{2}$ ounces per bird a consumption of potatoes sufficient to ensure normal growth and production is assured. An adult laying hen limited to $2\frac{1}{2}$ ounces of meals per day (or a mixture of meal and grain) will consume 10 ounces of potatoes. In poultry feeding about half the meal which would normally be fed in an all meal ration may thus be spared by potato feeding.

Whether foods are abundant and varied, or scarce and few, the balancing of the ration for farm animals is important. A pig fed from weaning stage to fat condition on a properly balanced ration puts on 1 cwt. of live weight increase for each $3\frac{3}{4}$ cwts. of meals or meal equivalent consumed. In present circumstances in particular a run on pasture or an allowance of greens, such as cabbage or kale or rape, 3 or 4 times a week, is necessary to balance the ration as is a supply of separated milk or, in its absence, meat meal. The proportion of meat meal is 1 to 9 of other meals when all-meal feeding is practised and 1 to 5 of meals when only half the ration is meal, the remainder consisting of potatoes. In the absence of green food and of meat meal (or separated milk) a pig consuming barley, oats and potatoes would require 5 or 6 cwts. of meal or meal equivalent for the addition of 1 cwt. of live weight increase. Thus, a great saving is effected by "balancing" up the ration. Excellent results are obtainable from a diet of oats, barley, potatoes, separated milk (or meat meal) and green feeding. Pigs consume a considerable quantity of pasture, if the herbage is young and fresh, and one of the best means of saving meal in pig feeding is to graze the animals for some hours each day on young pasture. For bonhams, it is essential to cook the meal if oats only is available, but cooking is not essential if barley is used. Whether oats alone or a mixture of oats and barley is fed, the incorporation of cooked potatoes, from the very earliest stages of feeding is a decided advantage.

The consumption by chickens for the first week or two of life is so little that expensive foods such as oatmeal or stale bread crumbs are justifiable. These may be gradually replaced by finely ground oats and barley mixed with some boiled potatoes. If oats alone is available cooking, though not very helpful, may be resorted to, the cooked meal being dried off with boiled potatoes or with a little uncooked ground oats. Beyond the age of 5 or 6 weeks, cooking is no longer advisable even when the only meal obtainable is ground oats. Screenings from threshing mills should be reserved for chickens and fed as grain; they are much relished and add to the concentration of the diet. Milk is invaluable for chickens and laying fowl, and, as in the case of pigs, if none is to be had, meat meal, to the extent of about 8 per cent. is called for. Green feeding is an absolute

essential, and if the chickens are not on pasture they must have a regular supply of greens fed to them. Adult fowl on range, fed on milk and oats or a mixture of oats and barley together with boiled potatoes produce satisfactorily.

In order to secure the maximum value from home produced foods fed to pigs or to poultry, particularly chickens, kept indoors, light must be given free access to the compartments. Direct light promotes thriftiness, prevents stiffness and rickets, and makes for more profitable husbandry.

At present prices the production of pork and eggs is profitable by utilising the type of dietary outlined, but the numbers of pigs and poultry which can be fed depends on the quantity of foods produced from tillage crops. Similarly, in the case of cattle and sheep a full and complete dietary is forthcoming from the produce of our own land, and the type and intensity of crop husbandry this season will determine the extent to which animal products may be increased. Pastures yield more if grazed in rotation than they will if animals have free liberty to roam over the entire pasture area continuously. By rotation grazing is understood the divisions of the pasture into sections each of which may consist of one or more fields, each section being grazed and left idle at alternate intervals, so that the stock rotate round the different sections at intervals depending on the grass available to them. Pasture herbage is inclined to grow into flowering and seed heads as the year progresses with the result that the sole thins out and productivity decreases. Topping of the herbage about July with a mowing machine set high, checks this inclination and stimulates a thick growth of bottom grasses and clovers. Judicious management also favours the production of an early spring pasture. Land left unstocked in August and September, then grazed till eaten down and again left unstocked till the spring, comes along in April with a vigorous growth well ahead of pasture not so treated. Thus, an early bite is favoured, and if a dressing of farmyard manure could be applied in winter the results would exceed anything to be expected from artificial manures.

More milk production depends on better grass land husbandry and on the production of supplementary feeding. Silage on farms where grass can be spared for ensiling, green forage crops such as cabbage, kale, rye, hardy greens, and rye grass on other farms together with roots and good hay are the most important supplementary foods. Good hay, that is if cut early and made up without suffering from weather action, is half as good as oats, poor quality hay is only one quarter the value of oats. Silage and green foods are excellently balanced, and highly nutritive. For moderate and high yielding animals whose diet includes corn and perhaps sugar pulp the balancing of the cereal diet may be done with meat meal, a food which is at first disliked by cattle but which when they become accustomed to it is much relished. Meat meal should be introduced gradually to cattle and mixed with other meals and, to begin with at any rate, with chopped

roots or other food likely to cloak the flavour of the meat meal. One part of meat to six of other meals such as crushed oats is ample. Actually, however, the supply of a sufficient quantity of home produced foods is more important than undue concentration on the formula for the meal mixture. However, the variety of foods mentioned provides for the requirements not alone of dairy cows but of calves, fattening cattle, suckling ewes and lambs. For the time being at any rate oil cakes and maize have disappeared from the menu of farmstock, but as the years go by we find that a full diet for all farm animals can be liberally provided in the absence of these foods which, prior to the war, we should have thought could not have been done without.

ALLOTMENTS

Broadcast talk given by MR. JOHN McCALL, General Secretary, Irish Allotment Holders' Association, on Friday, 8th January, 1943.

The allotment movement took practical shape in this country during the period of the last European War. During these years, the scheme made considerable progress but was availed of mainly by employed persons resident in the larger cities and towns. A somewhat barren period followed the close of the war. The number of allotments declined considerably owing to causes over which many plotholders had no control. It was recognised, however, that the movement had many desirable features even in peace times and with a view to placing it on a more secure footing the Acquisition of Land (Allotments) Act was passed in 1926. This Act enabled Local Authorities to acquire land by agreement or compulsion and to parcel it out in allotments at an economic rent. An Amending Act was passed in 1934 to enable Local Authorities to provide land for unemployed persons at a nominal rent and to supply them, free of cost, with seeds, manures, spraying materials and the use of implements. The passing of these Acts gave considerable impetus to the Allotment movement.

I am primarily interested in the Allotments Scheme for the Dublin County Borough in which area the scheme is administered by the Irish Allotment-Holders' Association, a voluntary organisation founded in 1917 and it is to this area I propose to confine my present talk.

In the Dublin area following the outbreak of the present war there was a marked increase in the number of applications for plots, especially from unemployed men. The position in the years 1939 and 1942 was as follows:—

Year	Total No. of Allotments cultivated	Number cultivated by Unemployed.
1939	1,146	566
1942	7,200	4,140

You will see from these figures that there was an increase in the total number of allotments cultivated of 6,054 and in the number of allotments worked by unemployed there was an increase of 3,574. We had in the 1942 season in Dublin about 800 statute acres under cultivation. Estimating the value of the produce to an allotment-holder at an average figure of £10 it will be seen that the value of the food produced from plots last season would be in the neighbourhood of £72,000. Again it is not unreasonable to assume that the average family in this city consists of six persons which would mean that about 43,200 persons or nearly 1/10th of the population of Dublin obtained fresh vegetables from allotments in the season just passed.

There are two classes of allotment-holders.

1. Persons who are in regular employment;
2. Persons who are unemployed.

To the persons who are in employment the rent of a plot is £1 for the season while the rent to an unemployed person is merely a nominal sum of 3/-.

The primary object of the scheme is to provide allotments for unemployed persons and we consider applications from persons in regular employment only after all approved unemployed applicants have been accommodated. In the case of the unemployed allotment-holders they are supplied with the plots and requisites from a Government Grant. On payment of the nominal sum of 3/- which I previously mentioned, an approved unemployed allotment-holder is supplied with:

$1\frac{1}{2}$ cwts. Certified seed potatoes;
$\frac{1}{2}$ oz. swede turnip seed;
$\frac{1}{4}$,, lettuce seed;
$\frac{1}{2}$,, beet seed;
1 ,, cabbage seed;
$\frac{1}{2}$,, parsnip seed;
1 ,, onion seed;
100 cabbage plants;
100 Tripoli onion plants;
1 ton good quality farmyard manure

and the use of a spade to cultivate the plot. In addition they have their potato crops sprayed twice for which no further charge is made. In short an unemployed allotment-holder has only to pay 3/- and cultivate his plot.

Everything else is supplied free of cost from the Grants provided by the Government for the purpose.

Having heard of all these good things which are given free of cost I am quite sure that there are many listeners who at the moment are unemployed and have not yet got a plot and are wondering what is to be done to get one under the free scheme. Well, all you have to do is to go to the Corporation Allotments Office at 6, Clarendon Row, Dublin. There you will find a very sympathetic staff acting under the supervision of the Corporation Allotments Officers, Mr. J. J. Rowe and Mr. E. J. Finlay, both of whom have long experience of allotments work and who take a keen personal interest in the scheme. Help the staff there to complete your application form by answering the questions asked of you and then take the form which you will be handed to the Employment Exchange immediately to have it completed and then bring it back to 6, Clarendon Row again. If you are approved by the Corporation Allotments Staff as eligible for a free plot under the Government Scheme you will be notified by the Corporation to attend at a selected allotment field to be given your plot.

If you wish your name to be considered for a plot you should go to 6, Clarendon Row immediately as the time is getting late and your application may not be considered. Another thing, when you get the form to bring to the Employment Exchange for completion do not put it in your pocket and forget all about it. I am also sure that there are many of you listeners who are unemployed and who would simply love to have a plot and be able to bring home a sack full of fresh vegetables, throw it on the kitchen floor and say "I grew these myself" but you are afraid to apply for a plot because you never used a spade in your life and you know nothing about growing vegetables. You are just the type of person we want. The Government, through the Department of Agriculture, provide Allotment Instructors who will give you all the information and advice you will require in the digging of a plot and the sowing of the small seeds and potatoes. These Instructors visit the various plot areas every day and soon observe those who need instruction and help most. You will be shown how to commence digging your plot and how to make the various seed beds and sow the plants. These Instructors are in attendance all the summer to advise and help you. If the Instructors do not happen to come to you simply go to them and ask for advice.

The Department of Agriculture also issues a leaflet No. 36, free of cost, which is available again this year. If you get a copy of this leaflet which is usually distributed by the Association it will also give you much information on how to cultivate a plot. The Department also issues a publication entitled "Seasonal Notes for the Garden and Allotment" in which reference is made to a number of other leaflets of interest to allotment-holders.

Should any listeners who are in employment desire a plot they should

make immediate application to the Corporation Allotments Office, 6, Clarendon Row, where their application will be considered. Plots will be made available for persons in employment and there should be no hesitation on your part to make application if you are able and willing to cultivate an allotment. I must mention that schemes similar to those in Dublin are in operation in almost every city and town in the country and what has been done in Dublin can be done equally well, if not better, in most parts of the country. Our experience has shown that even persons with no previous knowledge of gardening have produced splendid results in their first year. As a matter of fact some of our first prize winners have been first year allotment-holders.

Employed persons provide their own seeds, implements and other plot requisites. The Association endeavours to help the employed allotment-holders by making available seed potatoes at little more than cost price.

Listeners who reside in towns and cities other than Dublin should make application for allotments to the local Town Clerk or the Secretary of a Local Authority or local Association. Last season there were 45 allotment areas worked in Dublin to which this year is added Howth.

The Trustees of the Association appoint an Honorary Secretary to each group of areas whose responsibility it is to distribute the allotments, collect the rents and issue the seeds, implements and manures to the unemployed allotment-holders of their areas. Last year the following quantities of seeds were issued:—

310 tons of certified seed potatoes;
130 lbs. swede turnip;
65 ,, lettuce seed;
130 lbs. beet seed;
260 lbs. cabbage seed;
260 lbs. onion seed;
130 lbs. parsnip seed;
414,000 cabbage plants:
414,000 tripoli onion plants.

Only first quality seeds are supplied and each unemployed man must sign in the Area Register for the requisites issued to him. In addition approximately 1,100 tons of first quality farmyard manure were distributed, about 4,000 spades are issued on loan to the unemployed and these are collected at the end of each season by the Area Secretary. At the moment there are about 200 unreturned for the past seasons.

The Royal Dublin Society has contributed approximately £100 towards a Prize Scheme. This Prize Scheme is divided into two groups, a separate scheme for employed and unemployed holders. The plots were adjudicated

by members of the Royal Horticultural Society. The scheme was much appreciated and was a great success. The prizes were £1 first, 15/- 2nd., and 10/- 3rd and prize money was forwarded to the members on Christmas Eve when the money was most welcome.

The plans for the coming season are well advanced, about 6,000 of the plots have already been let to last year's allotment-holders. Both employed and unemployed allotment-holders are given the same plots each year as they worked the previous year unless they desire a transfer. In addition I understand that there are some 1,500 new applications for plots with the Corporation. Already about 500 tons of farmyard manure have been distributed to the unemployed allotment-holders who have renewed the letting of their plots for a further season. Tender forms for the supply of certified seed potatoes, small seeds and other requisites have already been forwarded to the merchants. The collection of the implements will be completed in the next few days and the implements re-issued. Each allotment-holder is given the same implement as he used the previous year.

Within the next week or so the new unemployed applicants will be sent by the Corporation to the various allotment areas to take over the plots which are still vacant so I would advise any person, particularly the unemployed for whom so many facilities are provided to make application without further delay.

To our old friends who have taken plots with us in past years we wish every success in the coming season, and to those who are starting for the first time we extend the hand of encouragement.

BARLEY

Broadcast talk given by PROFESSOR M. CAFFREY, Head of Plant Breeding Division, University College, Dublin, on Saturday, 6th March, 1943.

There is evidence to show that barley was the first of the cereals to be brought under cultivation. Ancient mythology has it that Ceres, one of the Gods, gave it to the human race as the first article of food. Long before the dawn of recorded history neolithic man used it almost exclusively, and very well preserved stocks of barley laid down from five to ten thousand years ago have been recovered from the straw-lined burial cysts of these ancient peoples. By them and by their successors it was exclusively used in religious rites. We are told that when used sacrificially barley went by a primeval name *ulai*, a word so ancient that all endeavours to trace it etymologically have failed.

Barley was the chief article of food of the ancient Greeks. They used to roast it, roughly grind it, then eat it with oil and condiments. By them it was known as "alphita," and it is interesting to note that *alphita* had the same wide meaning and significance as "bread" has with us to-day. The Greeks used to refer with pride to their *alphita patroa*, or their national heritage.

The Romans also used barley extensively and many of their writers referred to it. They showed their appreciation of its value and importance in their agriculture and their national life by putting an impression of an ear of barley on the obverse side of one of their coins, thus anticipating by over twenty centuries the efforts of a modern state to pay similar homage to its live stock—its cattle, pigs, horses and poultry.

Down through the ages, barley, in spite of many vicissitudes has always held a prominent and even a dominating position among the grain producing plants. Robert Burns, who was a farmer as well as the national poet of Scotland, wrote:

"Let husky wheat the haugh's adorn
And aits send up her awnie horn
And pease and beans at een and morn
Perfume the plain
Leeze me on thee John Barleycorn
Thou, king of grain."

Burns here gives us a pleasing picture of the crop plants grown by the Scottish farmer towards the end of the eighteenth century. It will be noted, by the way, that the farmers of that period grew a greater variety of seed producing crops than at present; their choice of crops, moreover, supplied proteins as well as carbohydrates and, therefore, provided a better balance than now for feeding purposes. Among them all Burns placed barley first. Barley was also widely grown in Ireland during the same period as will be clear to those who have read Young's "Tour in Ireland" in which there are numerous references to barley and bere.

Until recently barley bread was widely used by all civilized peoples. Burns in the poem already referred to mentions its "Souple scones the wale of food." Now, however, rice, wheat, and rye, have entirely replaced it as a human food everywhere. This circumstance, which might have been fatal to any other grain crop, has not affected barley as seriously as might have been expected, for its ability as a producer of food for live stock purposes is unsurpassed by any other cereal in the temperate regions of the world. Furthermore, its unique properties as raw material for the production of alcoholic drinks, both brewed and distilled, has rendered its position in the world's agriculture an unassailable one.

To-day, barley is grown in every country in Europe. In America it

is propagated from Hudson's Bay to Cape Horn. It grows within the Artic Circle as well as on the plains of India. It is propagated in the mountain lands of Abyssinia, on the table lands of Tibet; it is even found on the slopes of Everest itself. It is cultivated on the borders of the Sahara desert where the rainfall is less than 5 inches per annum, and in the West of Ireland under a rainfall of up to fifty inches. Vigorous wild forms are aggressive species in permanent pastures in the east of England holding their own with perennial rye grass and cocksfoot. In this country a wild species is rampant in Co. Dublin, and vigorous colonies have established themselves firmly even in the suburbs of our city.

Apart from its inherent value for brewing and distilling and as a feed provider, there are other reasons why barley is popular with the tillage farmer. No crop is so cheap to handle. No other crop, with the possible exception of wheat takes so little out of the soil. It is not periodically devastated by epidemics like the rusts and root diseases and, therefore, gives a good return year by year. It is pre-eminently the crop for the small farmer who is unable to expend much capital on manuring and tilling. Moreover, for many farmers it is a cash crop, easy to dispose of if the grain has been well ripened, well saved, and well threshed, always provided, of course, that a variety of high quality has been grown.

In order to enable itself to become adapted to such a wide range of soil and climatic conditions, it was essential that the barley plant should have initially possessed the characteristics of high variability, and great powers of adaptation in regard to soil and climate. At present there are numerous species and literally thousands of varieties throughout the world. There are six-row, two-row and intermediate types in abundance. Moreover, there is great variation in grain colour; white, cream, yellow, purple, blue and black grained forms being extensively cultivated. In respect of development some forms, (for example, 'bere,' and other winter types), are as slow in producing ripened crops as winter wheat, while on the other hand extremely early ripening forms capable of completing all stages of growth within 60 days, are under cultivation at the Soviet Plant Breeding Station at Hibiny situated well within the Arctic Circle.

In common with all other cultivated plants there are certain optimum conditions under which barley will produce grain of the highest possible yield and quality. While tolerant of heat especially if the atmosphere is dry, barley does best in temperate regions under sunny, moist, and comparatively cool conditions, particularly during the development and ripening of the grain. These conditions ensure the production of well-filled grain of high carbohydrate content. The climatic conditions obtaining here are, therefore, suited for the production of barley of high malting quality particularly in those areas where the soil does not contain an excessive amount of available nitrogenous compounds.

It would appear that up to the end of the eighteenth century winter as well as spring types were grown in Ireland. The winter barleys were all six-rowed and were given the name of 'bere.' The spring barleys were two-rowed, they were described generally as 'barley' and each district had its own adapted variety with a distinctive local name. Nearly all these old native types have unfortunately now disappeared; only one of them, Old Irish—a very vigorous two-row spring barley, still propagated in Wexford—has held its own against the competition of higher quality varieties. Fortunately, some remnants of the old varieties can be found under cultivation in isolated areas, particularly in Donegal, Cork, and Galway, and it is to the national interest that these should be preserved.

Barley importations especially from Great Britain have been prevalent all during the past century. These, in common with all other crop introductions, were, until quite recently, entirely uncontrolled, and no preliminary attempt was made to determine whether they carried insect or fungoid diseases or to ascertain their suitability for wide scale cultivation in this country. There were naturally under the circumstances some good but also many undesirable introductions. Most of the foreign varieties which established themselves here were adapted for growing only in small and well defined areas and were not well suited for wide scale propagation. The majority of these were of good malting quality but all without exception were weak in the straw and of poor yielding capacity judging by present-day standards.

From the malting as well as from the agricultural point of view the situation described could not be regarded as satisfactory. For the production of malt of the highest grade a uniform product is a primary requisite. Different barley varieties behave differently on the malt floor and a product of high quality can be obtained only when a single variety is represented in any particular steep. The ideal then, as now, was a single dominant prolific variety suited for cultivation throughout the whole country. This essential was appreciated by the newly created Department of Agriculture, which in 1904 set up a Plant Breeding Division having as its principal aim the production and propagation of improved varieties of the cereals.

This particular Division immediately turned its attention to the improvement of barley. It was aided in this aspect of its work by a substantial money grant from Messrs. Guinness who also undertook to determine the malting quality of all the promising new varieties that would be produced.

Then began an investigation which in its conception, planning, operation, and successful conclusion will in future be regarded as a classic in agricultural science. Very briefly, this involved in the first place, the carrying out of hundreds of field experiments conducted all over the country.

This was followed by the raising and testing of numerous pedigree strains of the leading varieties, and finally through the agency of cross-fertilization, new and improved varieties having superior combinations of the characters exhibited by the best of these strains were obtained and fixed by careful selection. The final result was that the outstanding problems then confronting the Irish barley grower and the Irish maltster were solved and to the record of plant breeding experimentation was added one of its brightest and most valuable chapters.

The first step was naturally to get definite information in regard to the comparative yields and malting quality of the most widely grown varieties. A series of experiments were immediately instituted, to determine (a) the best narrow-ear and, (b) the best broad-ear variety. The central idea was to select a standard variety in each experimental series and to compare each of the other varieties separately and in various combinations with this particular variety. The experiments were, therefore, extremely simple and effective, and they were all conducted over a number of years so as to ascertain the differential influence of weather conditions on the varieties under experiment. The final result was that Archer was proved to be the best narrowear and Goldthorpe the best wide-ear variety. A final series of experiments comprising 67 tests and extending over eight years demonstrated beyond all doubt the superiority of Archer over Goldthorpe.

During these investigations an interesting problem was raised due to the introduction of a stock of Archer from Denmark known as Tystofte Prentice or Danish Archer; when tested against commercial Irish Archer it proved to be superior to the latter in yield and malting quality. This was rather disquieting as well as curious as both barleys had similar botanical characters. It was considered that the superiority of the Danish to the native stock might have been due either to the possible beneficial effect of a 'change of seed.' or to the use of a superior strain of Archer, or, to both causes operating together.

The question as to whether Danish seed was essentially superior to Irish grown seed because of its origin was determined in this way. Danish Archer imported in 1906 and subsequently propagated in this country was tested during the years '07, '08, '09 and '10 against Danish Archer which was freshly imported in each of these particular years. Thus, in 1907 Danish Archer grown one year in Ireland was tested against freshly imported seed, while in 1910 the freshly imported Danish Archer was tested against Danish Archer grown continuously for the four previous years in this country. The experiments showed clearly that the place of origin of the seed had no important effect whatever in determining the quality and the yield of the resulting crop.

In order to test the effects of 'strain' on yield and quality, a 'mass

selected' stock of Irish Archer was made available for test in 1907, and 1908 and subsequently a superior pedigree stock, (i.e. the produce of a single plant) of Irish Archer was included in the experiments. Both were tested against Danish Archer; the mass selected stock proved inferior but the pedigree strain of Irish Archer was fully equal in yield and slightly superior in quality to Danish Archer. In consequence of these experiments the importation of barley seed from Denmark which started in 1906 and then rapidly increased, was arrested and finally ceased altogether. The net result was that a pedigree strain of Archer barley possessing high yield and excellent quality, native to the soil, and suited for cultivation in every barley growing district was produced, propagated and made available to Irish farmers. The returns from the use of this seed were entirely satisfactory, and the additional income accruing to the barley growers from the use of the native pedigree stock was calculated to be over £50,000 per annum. Moreover, the brewers and distillers also benefitted directly by getting a more uniform and a higher quality product.

The next problem was to obtain, if possible, new and improved varieties by hybridization. It is a well known scientific fact that when two varieties of any crop are crossed together, it is usually possible to obtain in the progeny, new forms combining in a more useful degree than that possessed by either parent, those particular characters in which the parent plants were differentiated. Thus, when Archer barley which is narrow-eared and has a short 'neck' is crossed with Goldthorpe which is a broad-eared, long-necked variety, forms are obtained in the progeny combining the broad ear of the Goldthorpe parent with the short neck of Archer. Moreover, inter-varietal crossings may give derivatives possessing some character or characters common to both parents: e.g., quality or yield, in a higher degree than that possessed by either parent—this is known as transgressive segregation.

Many crosses were made between strains of Archer, Goldthorpe, Spratt and Chevallier. The cross which gave the most promising progeny was that between Archer and Spratt which was made in 1907. In 1909, there were 41 plants in the F2 generation and from one of these viz: from plant No. 37 was derived all the famous Spratt Archer barleys 37/6, 37/18, 37 No. 3. 37 No. 4, etc., now widely grown in Ireland, Great Britain and to a lesser degree throughout the world.

A small quantity of a mixed stock of Spratt-Archer 37 was released during the years 1915 and 1916. Although the Department of Agriculture took no active part in its initial propagation and distribution—being entirely engaged in food production during the war years—yet so prolific and well suited was this stock for cultivation throughout the whole Irish barley growing area that when the first great war was over and the Department had resumed its many functions and activities including variety testing, propagation and seed distribution it was found that the cultivation of this

particular stock of Spratt-Archer barley had in the mean-time spread enormously. It was available to farmers in practically every barley district. This must be regarded as a tribute to the Irish farmers' knowledge, enterprise, and business acumen. He is always keen to use and to share any new discovery that promises to be of value in the pursuit of his profession.

By the year 1919, the Plant Breeding Division had available a pedigree strain of Spratt-Archer known as Spratt-Archer 37/6. This particular strain was first included in the trials laid down in 1919 and was continued for 6 years. The results in comparison with the pedigree strain of Archer are of great interest. They are as follows:

				c.	q.
1919	26	centres	Spratt-Archer	24.	0
			Archer	22.	0
1920	18	,,	Spratt-Archer	24.	0½
			Archer	22.	1
1921	18	,,	Spratt-Archer	26.	1
			Archer	23.	0
1922	19	,,	Spratt-Archer	26.	2
			Archer	22.	0
1923	20	,,	Spratt-Archer	22.	2
			Archer	20.	1
1924	13	,,	Spratt-Archer	21.	1
			Archer	19.	3

The results show that the introduction of Spratt Archer had increased the yield of Irish barley by over 12½ per cent. over that of pedigree Archer, itself an improved variety. The actual yield was increased by well over a barrel of grain per statute acre, and the national income of the barley growers was increased by an additional £100,000 per annum. All this was secured through the expenditure of a few thousand pounds per year. This furnishes evidence, if evidence be needed, that money devoted to agricultural research is always well and wisely spent.

Spratt-Archer 37/6 in its turn gave way before a new strain derived from the same original mother plant and now known as Spratt-Archer 37 No. 3. This particular strain was selected from a crop derived from the original seed which, as has previously been stated, was released during the years 1915 and 1916. Spratt-Archer 37 No. 3 is greyer in colour, plumper in the grain and slightly more prolific than Spratt-Archer 37/6. Moreover, the grain is definitely of higher quality for malting purposes. For many years it has been grown almost to the exclusion of all other varieties in Ireland, and has given entire satisfaction. It is unlikely that any better variety, taking into consideration yield and quality, and suitability for cultivation under the prevailing soil and climatic conditions, has ever been raised by any Plant Breeding Institute in any country.

SEED PROPAGATION.

It is a truism that no amount of successful plant breeding is of avail unless arrangements are made to ensure that ample pedigree stocks of healthy vigorous seed of improved varieties are annually or, at least, periodically made available to farmers at a reasonable price. This particular aspect of plant propagation is of prime importance and it is not as easy to secure it as would appear from a superficial survey of the problem. Different countries have dealt with the matter differently and it would be an interesting and fruitful subject to discuss various countries' methods of seed propagation and distribution and to devise in the light of the experience they have gained suitable methods applicable in this country to each particular crop.

The large scale propagation and distribution of barley seed has been undertaken by the Department of Agriculture in collaboration with Messrs. Guinness. Each year about 500 barrels of pedigree seed of Spratt Archer No. 3 is raised by the Department's Seed Propagation Division at Ballinacurra, Co. Cork. This is distributed to the various maltsters and large seed firms throughout the country. The seed is grown under contract, and provided it is satisfactory, in every respect, it is purchased by maltsters and reserved for seed the following year. Lists of farmers growing 1st and 2nd year stocks of barley ex Ballinacurra are supplied annually to the Department. The Agricultural Instructors make a careful inspection of each crop, and their observations are supplied to the maltsters concerned. Crops which pass the rigid tests now prescribed: a genuineness percentage of over 99 per cent., and a complete freedom from 'covered smut' and other diseases, are brought for seed purposes. The net result of all this activity is that over 95 per cent. of the barley grown in Ireland is Spratt Archer 37 No. 3. The crops of this variety have a genuineness of over 99.9 per cent. and as regards freedom from covered smut, which can be controlled by powder disinfectants. our barley crops approach absolute purity.

Spratt Archer barley has done very well in England and Scotland. At the present moment it is believed to be a dominant variety in both countries. The actual areas under each of the large number of varieties grown in England are not available but the following figures collated from the records of "The Official Seed Testing Station" of Great Britain show clearly the trend in England as regards the varieties under cultivation between the years 1922 and 1935.

Percentages of named Varieties of Barley received by the Official Seed Testing Station.

No. of named Samples	Crop 1922	Crop 1935
New Varieties:		
Spratt Archer	2.0	37.4
Plumage Archer	16.6	30.1
Plumage	6.4	10.5
New Cross	——	4.9
Golden Archer	——	3.4

Old Varieties:

Standwell	13.2	1.7
Chevallier	12.4	1.5
Archer	10.2	3.4
Burton Malting	6.9	1.0
Goldthorpe	3.4	1.2
Binder	2.7	.3

Within recent years certain circumstances have arisen which will have an important influence on the future of barley growing in Ireland, and on methods and particularly the aims of those who are entrusted with the production and propagation of new well-adapted varieties.

The demand for malting barley of the type grown at present is likely to remain stationary or even to decrease. Less alcoholic drink is being consumed by our people. This is due in part to ceaseless propaganda against drink by religious, economic and medical authorities and in part to its high cost due to the heavy excise duties on all kinds of alcoholic stimulants. Moreover there is now developing a remunerative market for all types of feeding barley which are excellent for the production of high quality bacon.

There is a possibility, well worth looking into, that the Irish grower may be able to supply to the brewers a type of malting barley which up to the present has been obtained from other sources. It is well known that large quantities of six-row barley were in pre-war years imported every year chiefly from California and used in combination with the home grown barley. Brewers and distillers assert that six-row barleys which contain a much higher percentage of husk than two-row types are both convenient and useful in the mash tun as the boiled liquid drains through much more easily when they are present in quantity. It may be that imported six row barleys have something which Irish barley can never possess, but at any rate the investigations in the breeding of good quality six-row varieties is worth the trouble.

In view of the shortage of supplies of maize due to war conditions there is at the moment an insistent demand for feeding barley. It is estimated that if this country is to maintain its normal supplies of bacon needed for home consumption it will be necessary to grow annually 130,000 extra acres of barley for feeding to pigs and other live stock. Here high yield of grain and sure quality is the most important consideration. It will be found, however, that Spratt Archer 37 No. 3 is the most prolific and the safest variety to grow on poor and average soils, on very fertile soils the growing of this particular variety is not advisable owing to its liability to lodge if the weather conditions are unfavourable during the summer months. There is, therefore, the problem of producing and making available to farmers varieties of feeding barley capable of being grown with safety on rich soils.

The production of stiff-strawed, lodging resistant and prolific barley varieties is now quite feasible. There is available excellent material from many sources which can be employed either directly or used to cross with our own prolific and well-adapted varieties in the production of new varieties capable of standing erect to harvest under the most unfavourable climatic conditions. The late Dr. Beaven obtained some remarkable six-row varieties notably *F*.112 which has very short stiff straw. The Danish investigators, who have been so successful in breeding strong strawed wheats, e.g. Pajbjerg, have recently produced two barleys, Kenia and Maja, which can be grown successfully on fertile soils. In addition other recent introductions notably Trebi have been remarkable for the shortness and strength of their straw.

The Plant Breeding Department of University College, Dublin, have crossed Kenia and Maja with Spratt Archer and have obtained many outstanding derivatives which appear to be well suited for growing on rich soils. The best of these have been propagated and are now being grown in large plots so as to observe their yield and lodging resistance capacity under field conditions. Pending the result of these, and of further trials to test their adaptability for cultivation on a wide scale the question of their large scale propagation and distribution must be held in abeyance.

VARIETY TESTS FROM 1919 ONWARDS.

Irish Field Experiments Under D.A.T.I.

1919.

Variety.	Average Yield per St. Acre.					
	Grain (26 centres)				Straw (17 centres)	
	C.	q.	Brls.	Sts.	C.	q.
Archer x Spratt 37/6	24	0	12	0	31	0
Archer	22	0	11	0	29	0
Archer x Goldthorpe 4/5/1.	21	3	10	14	31	0
Goldthorpe	20	1	10	0	32	0

1920.

Variety.	Average Yield per St. Acre.					
	Grain (18 centres)				Straw (18 centres)	
	C.	q.	Brls.	St.	C.	q.
Spratt x Archer 37/6	24	$0\frac{1}{2}$	12	2	34	0
Archer	22	1	11	4	33	0
Archer x Goldthorpe 4/5/1.	22	0	11	0	33	0

1921.

Variety.	Average Yield per St. Acre.					
	Grain (18 centres)				Straw (18 centres)	
	C.	q.	Brls.	St.	C.	q.
Spratt x Archer 37/6	26	1	13	2	30	1
Archer	23	0	11	8	29	2
Archer x Goldthorpe 4/5/1.	22	2	11	4	28	2
Garton's 1917	22	2	11	4	28	1

1929. Large Scale Var. Experiments, 1929.

Variety.	Average Yield per St. Acre. Grain Brls.	St.	Centres (Av. 10 centres)
Spratt Archer 37/6	12	9	
Spratt Archer 37 No. 3	13	3	
Spratt Archer 37 No. 4	12	15	
A. G. S. 3/3/3	11	14	
Old Irish	11	4	(1 centre)
July Six-Rowed	10	11	(1 centre)

No report on barley found in the Journals for 1930 and 1931.

1932. Large Scale Barley Var. Experiments, 1932.

Variety.	Average Yield per St. Acre. Grain Brls.	St.	(10 centres)
D. S. K. Binder	13	7	—
Spratt Archer 37 No. 3	12	13	—
Spratt Archer 37 No. 4	6	4	—
Spratt Archer x Goldthorpe No. 1 Spratt.	5	14	—

REPORT OF THE SEED PROPAGATION DIVISION, 1942.

As in previous years the bulk of the barley propagations and other investigational work was carried out at the Cereal Station, Ballinacurra, Co. Cork, in close collaboration with Messrs. A. Guinness, Son & Co., Ltd., at whose Experimental Maltings the malting tests were conducted. The work consisted of the usual pure line propagations, large scale variety, half-drill strip and other experiments.

Pure line propagations of Red Marvel wheat and Black Tartary oats were maintained at the Cereal Station and extension plots of Red Marvel wheat, Victory II and Ardri oats were grown in the neighbourhood of Ballinacurra.

WEATHER CONDITIONS.

During the month of January the weather was very broken but fine weather throughout the whole of February facilitated farm work and wheat was sown under good conditions. The first half of March was cold and wet but this was followed by a fortnight of warm, sunny weather during which good progress was made with the sowing of spring cereal crops. Strong winds with heavy rain in early April were followed by a period of bright sunshine accompanied by harsh easterly winds which resulted in drought and a consequent check to plant growth. The weather broke early in May and cold, wet, squally weather with periodic thunder was experienced during the remainder of that month. June brought another spell of fine weather, with warm sunshine and excellent conditions for haymaking but root crops suffered from lack of moisture. Long periods of close, overcast weather occurred in July and crops made good growth during this month.

Harvesting commenced in August under bad weather conditions. Following heavy rainfall in the first week in September, conditions improved considerably although these two months showed a deficiency of 49 hours of sunshine below the average amount. Dry weather prevailed during October and November, enabling land to be cultivated and winter wheat sown under ideal conditions. By the end of November the drought had reached serious proportions and heavy rain which fell in December was of great benefit to crops and pastures and in replenishing streams and wells which had run dry.

BARLEY.

The method adopted in 1929 in the selection of Spratt-Archer 37 No. 3 was again followed in the selection of Spratt-Archer 37 No. 3 and Spratt-Archer 37 No. 4. This method consists of sowing five grains from every fifth plant of a single line in the preceding year. The pure line is thus composed of twenty-five, five grain lines.

In addition to the pure lines mentioned above, twenty-five ears of Spratt-Archer 37 No. 3 for experimental purposes and forty-six single line selections were cultivated in the old Cage at the Cereal Station, Ballinacurra. These were as follows :—

Spratt-Archer 37/6, Spratt-Archer 37/6 No. 7, Spratt-Archer 37 No. 3 H.9, Spratt-Archer 37 No. 4 (five grains from each of twenty-five plants), Spratt-Archer 37/9, Archer Goldthorpe 4/5/1, Spratt-Archer, Goldthorpe, Old Irish, Burton Malting, Victory, D.S.K. Binder, Plumage Archer, Duck Bill, Hybrid No. 1 C, Hybrid No. 4 A, Hybrid No. 4 B.1, Hybrid No. 7, Black Himalayan, Kenia, Neils Franchen, Naked Barley, Golden Archer 1, Golden Archer 2, Goldberg, Spratt-Archer 37 No. 3 x Victory 1, Spratt-Archer 37 No. 3 x Victory II, Glabron, Pearl, Donegal Six-Rowed, July Six-Rowed, Beavens F.112, Beavens 49/14/3, B. 244, Hybrid 4 B.1. x Golden Archer 1, Spratt-Archer 37/9 x Golden Archer 2 No. 1, Spratt-Archer 37/9 x Golden Archer 2 No. 2, Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 1/1, Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. ½, Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 2, Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1. No. 1, Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 2, Maja, Spratt-Archer 37 No. 3 H.9 3/7, Beaven's 54/12/3.

Garden, Field and First Pedigree plots as follows were grown on the farm of J. H. Bennett, Ltd., Ballinacurra :—

GARDEN PLOTS.

Spratt-Archer 37 No. 3 (25 lines).
D.S.K. Binder.
Golden Archer 2.
Spratt-Archer 37 No. 3 x Victory I.
Spratt-Archer 37 No. 3 x Victory II.
July Six-Rowed.
Hybrid 4 B.1 x Golden Archer 1.
Spratt-Archer H.9 x Golden Archer 2 No. 1/1.
Spratt-Archer H.9 x Golden Archer 2 No. ½.
Spratt-Archer H.9 x Golden Archer 2 No. 2.
Spratt-Archer H.9 x Hybrid 4 B.1 No. 1.
Spratt-Archer x Hybrid 4 B.1 No. 2.
Spratt-Archer 37/9 x Golden Archer 2 No. 1.
Spratt-Archer 37/9 x Golden Archer 2 No. 2.
Maja.
Spratt-Archer 37 No. 3 H.9 3/7.
Beavens 54/12/3 (S.A. x P.A.).

FIELD PLOTS.

Spratt-Archer 37 No. 3.
D.S.K. Binder.
Golden Archer 2.

Spratt-Archer 37 No. 3 x Victory I.
Spratt-Archer 37 No. 3 x Victory II.
July Six Rowed.
Hybrid 4 B.1 x Golden Archer.
Spratt-Archer H.9 x Golder Archer 2 No. 2.
Spratt-Archei H.9 x Hybrid 4 B.1 No. 2.
Spratt-Archer 37/9 Golden Archer 2 No. 1.
Spratt-Archer 37/9 x Golden Archer 2 No. 2.

FIRST PEDIGREE PLOTS.

Spratt-Archer 37 No. 3 (4 acres).
D.S.K. Binder (½ acre).
Spratt-Archer 37 No. 3 x Victory I (1 acre).
Spratt-Archer 37 No. 3 x Victory II (1 acre).
July Six-Rowed (1 acre).
Hybrid 4 B.1 x Golden Archer 1 (1·acre).
Spratt-Archer H.9 x Hybrid 4 B.1 No. 2 (1 acre)

The produce of these plots will be available in 1943 for further propagation and Large Scale Variety Experiments.

Second Pedigree Plots of Spratt-Archer 37 No. 3 were grown under contract with the following farmers in the neighbourhood of Ballinacurra :—

	Brls.	Sts.
M. Kelleher, Geragh, Ballinacurra.	5	8
R. Scanlon, Geragh, Ballinacurra.	4	6
P. McCarthy, Castleredmond, Ballinacurra.	2	8
R. Barry, Broomfield, Midleton.	5	0
J. O'Reilly, Ballinabointra, Carrigtwohill.	3	0
J. Hegarty, Ballinbeg, Rostellan.	4	8
J. Leahy, Innegrega, Ballinacurra.	5	0
	29	14

The produce of these plots will be available for distribution as nucleus stocks of pedigree seed in the spring of 1943.

For a number of years the Department has had in operation a scheme under which nucleus stocks of Pedigree Spratt-Archer barley are distributed each year to members of the Irish Maltsters' Association and others interested in seed barley distribution. Those who obtain such stocks undertake to have them grown with reliable farmers, to buy the produce, if suitable for seed purposes, and distribute it to growers in the following season. Until this scheme 360 barrels of Spratt-Archer 37 No. 3 were distributed to the following :—

		Brls.
Messrs.	Minch, Norton & Co. Ltd., Athy	35
,,	Minch, Norton & Co. Ltd., Nenagh	16
,,	Minch, Norton & Co. Ltd., Bagenalstown	12
,	Minch Norton & Co. Ltd. Barracore	12
,,	Minch Norton & Co. Ltd. Stradbally	15
,,	W. B. Nunn & Co. Wexford	10
,,	Beamish & Crawford Ltd., Cork	5
,,	N. Hardy & Co., Ltd., 72, Park St., Dundalk	10
,,	P. O'Meara & Sons, Ltd., Thurles	15
,,	Cairns Ltd., Drogheda	10
,,	J. Bolger & Co., Ltd., Ferns, Co. Wexford	10
,,	Birr Maltings, Ltd., Birr	10
,,	F. A. Waller & Co., Ltd., Banagher	12
,,	Geo. Read & Co., Roscrea	12
,,	Joshua Watson & Co., Ltd., Carlow	20
,,	Joshua Watson & Co., Ltd., Leighlinbridge	10
,,	W. J. O'Keeffe & Son, Wexford	10
,,	D. E. Williams Ltd., Tullamore	54
,,	P. & H. Egan, Ltd., Tullamore	22
,,	J. & A. Tarelton, Ltd., Tullamore	10
,,	R. Gibney & Co., Ltd., Portlaoighise	10
A. J. M. Reeves, Esq., Athgarvan Maltings, Co. Kildare		4
Messrs.	North Tipperary Maltings, Ltd., Nenagh	16
,,	Latchford & Sons, Ltd., Tralee	20
	TOTAL	360

In addition to the above, the following quantities of seed barley were also distributed:—

	Brls.	Sts.
D.S.K. Binder.		
To the Agricultural School, Athenry, Co. Galway	6	2
July Six-Rowed.		
To the Agricultural School, Athenry, Co. Galway	6	7

All seed sown at and distributed from Ballinacurra Cereal Station was treated with Agrosan powder.

INSPECTION OF GROWING CROPS FOR SEED PURPOSES.

In order that those who co-operate in the Scheme for the Distribution of Pedigree Spratt-Archer seed might have information regarding the suitability of the produce for seed purposes, the Department arranged to have the crops which were grown for this purpose inspected by the Agricultural Instructors before harvest. For inspection purposes the crops were divided into three classes:

(1) Crops grown from seed obtained from Ballinacurra in 1942 : (2) Crops grown from seed which was the produce of seed obtained from Ballinacurra in 1941 and (3) Crops grown from commercial seed of Spratt-Archer 37 No. 3. As regards (3), inspections were only made in those cases where the Maltsters concerned were of opinion that they would not have sufficient seed otherwise and so required inspections made of the most promising crops grown from commercial stocks.

A total of 5,504¾ statute acres was inspected, of which 5,078 acres were reported as likely to produce grain suitable for seed purposes if properly harvested. Of the 473½ acres inspected under category (1) 12¼ acres or 2.6 per cent. were rejected because of an undue admixture of wheat, oats and other barley.

In category (2) 3,373¾ acres were inspected and 287½ acres or 8.5 per cent. were rejected. The rejections were chiefly due to other barleys having been sown in the same fields, poor crops, smut and the presence of an undue amount of oats and wheat. Under category (3), 1,657½ acres were inspected and 127 acres or 7.6 per cent. were rejected for the same causes as in category (2).

From the number of crops rejected it is apparent that some distributors did not take sufficient care in the selection of growers and in having the seed properly treated with a fungicidal dressing before it was despatched to growers. It is desirable that firms co-operating in this scheme should exercise care in selecting growers and in treating the seed with a suitable powder dressing, if such is obtainable, before it is despatched to the growers.

LARGE SCALE BARLEY VARIETY EXPERIMENTS.

These experiments were carried out at ten centres in seven counties, one in each of Counties Cork, Tipperary, Kilkenny, Kildare and Louth, two in Offaly and three in Wexford. The seed used for the experiments was the produce of the First Pedigree plots established at the Cereal Station, Ballinacurra, Co. Cork in 1941. The area of the plots throughout was one statute acre, and the seeding was at the rate of 10 stones per statute acre. All the seed was dressed with Agrosan powder at the rate of 8 ozs. per barrel of seed. The three varieties sown at all centres were Spratt-Archer 37 No. 3, Hybrid 4 B.1 x Golden Archer 1, and Archer.

Sowing conditions were favourable, and all plots were sown by the 17th April.

At all centres the seed germinated well and at the end of May there was a good braird on all plots. Except at one centre there was very little lodging and good crops were produced. At Goresbridge the Spratt-Archer and Archer plots, which had been doing well, lodged badly and their yields were considerably reduced.

The names and addresses of the growers, the nature of the soil and sub-soil, the crops grown in the two previous years and the dates of sowing and harvesting are set out in Table I.

In Table II are set out the weights of grain per statute acre, the commercial value of the grain as determined by independent valuers, and the total value of the grain, including screenings which were valued at 6d. per stone.

The values thus determined are not those which would have been obtained in the season 1942, during which the price of barley was fixed at 35/- but they were based on an arbitrary price range closely related to the fixed price.

The results set out in Table II show that both Spratt-Archer 37 No. 3 and Hybrid 4 B.1 x Golden Archer 1 gave a higher average yield than Archer. There was, however, no significant difference in yield between any of the varieties. As regards the nitrogen content of the grain the results shown in Table III indicate that Spratt-Archer 37 No. 3 was significantly lower in nitrogen than the other varieties and therefore maintains its superiority in malting quality. Since Hybrid 4 B.1 x Golden Archer 1 has no advantage over Spratt-Archer 37 No. 3 or Archer in yield and is clearly inferior to them in nitrogen content it would appear to be unworthy of further propagation.

BARLEY HALF-DRILL STRIP EXPERIMENT.

In this experiment which was carried out on the farm of Messrs. John H. Bennett, Ltd., Spratt-Archer 37 No. 3 was tested against Spratt-Archer 37 No. 3 x Victory 1. The trial consisted of twenty-two strips of each variety, a strip being half the width of the corn drill. To ensure even sowing, the seed in each half of the drill was changed over for the sowing of the second half of the experiment.

The results which are set out in Table IV show that while Spratt-Archer 37 No. 3 x Victory 1 gave a slightly higher average yield than Spratt-Archer 37 No. 3, the difference was not significant. From the results of the analysis it is apparent that Spratt-Archer 37 No. 3 x Victory 1 promises no advantage over the standard variety.

TABLE I.

LARGE SCALE BARLEY VARIETY EXPERIMENTS, 1942.

Centre No.	Name and Address of Grower.	Description of Soil.	Previous Crops.	Date of Sowing.	Date of Harvesting.
1.	Wm. Tait, Rostellan, Co. Cork.	Medium Loam, Sub-soil, Shale.	1940—Barley. 1941—Mangels.	2/4/'42	22/8/'42
2.	P. Byrne, Ballygrannans, Wexford.	Sandy Loam, Sub-soil, Gravel.	1940—Barley. 1941—Beet.	2/4/'42	18/8/'42
3.	D. Morris, Tomahurra, Enniscorthy.	Shale Loam, Sub-soil, Shale	1940-Roots & Barley 1941—Roots.	26/3/'42	18/8/'42
4.	Mrs. Segrave, Dunany, Dunleer.	Strong Loam, Sub-soil, Gravel.	1940—Wheat. 1941—Turnips.	17/4/'42	20/8/'42
5.	M. Howlett, Ramsgrange, Wexford.	Stiff Loam, Sub-soil, Shale.	1940-Roots & Barley 1941—Roots.	2/4/'42	20/8/'42, 27/8/'42.
6.	M. P. Minch, Rockfield, Athy.	Deep Loam, Sub-soil, Gravel.	1940—Barley. 1941—Beet.	25/3/42.	17/8/'42.
7.	Wm. Mullins, Duninga House, Goresbridge.	Strong Loam, Gravel and Limestone.	1940—Lea. 1941—Lea.	1/4/'42.	19/8/'42.
8.	D. O'Brien, Ballinamere, Tullamore.	Gravelly Loam, Sub-soil Limestone.	1940—Oats. 1941—Roots.	6/4/42.	25/8/'42.
9.	J. Young, Garbally, Birr.	Light Loam, Sub-soil Limestone.	1940—Roots. 1941—Wheat.	16/4/'42.	26/8/'42.
10.	M. Carroll, Belleen, Nenagh.	Strong Loam, Sub-soil Limestone.	1940—Barley. 1941—Turnips.	16/4/'42.	18/8/'42.

TABLE II.

LARGE SCALE BARLEY VARIETY EXPERIMENTS, 1942. YIELD AND VALUE OF GRAIN PER STATUTE ACRE.

CENTRE.	Spratt-Archer 37 No. 3. Yield of Dressed Grain.	Spratt-Archer 37 No. 3. Screenings.	Spratt-Archer 37 No. 3. Value per barrel.	Spratt-Archer 37 No. 3. Total Value including Screenings	Archer. Yield of Dressed Grain.	Archer. Screenings.	Archer. Value per barrel.	Archer. Total Value including Screenings	Hybrid 4 B.1 x Golden Archer I. Yield of Dressed Grain.	Hybrid 4 B.1 x Golden Archer I. Screenings.	Hybrid 4 B.1 x Golden Archer I. Value per barrel.	Hybrid 4 B.1 x Golden Archer I. Total Value including Screenings
	brls. sts.	sts.	s. d.	£ s. d.	brls. sts.	sts.	s. d.	£ s. d.	brls. sts.	sts.	s. d.	£ s. d.
Cork. Wm. Tait.	14 15	3	35 3	26 8 0	13 10	4	35 1	24 0 0	13 10	2.5	35 5	24 3 10
Tipperary. M. Carroll.	10 3	4	35 0	17 18 7	9 12	4	34 11	17 2 5	10 2	4.5	35 3	17 19 2
Offaly, J. Young.	9 4	4	34 10	16 4 2	9 2	3.5	34 10	15 19 7	9 3	4	35 1	16 4 8
D. O'Brien.	10 11	3	34 9	18 12 11	9 4	4	34 9	16 3 5	10 9	3.5	34 9	18 8 9
Kildare. M. P. Minch.	14 8	1	35 4	25 12 10	13 14	2.5	35 4	24 11 6	14 13	1	35 3	26 2 8
Kilkenny. W. Mullins.	8 14	5.5	34 9	15 11 2	8 5	5.5	34 7	14 10 2	11 15	4	34 9	20 16 10
Wexford. M. Howlett.	14 2	7	35 1	24 19 1	13 8	6	35 2	23 17 9	13 14	6.5	35 2	24 11 2
P. Byrne.	10 2	2.5	34 10	17 13 11	12 13	3	34 7½	22 5 2	11 5	3	35 0	19 17 5
D. Morris.	14 3	2.5	35 3	25 1 4	12 5	3.5	35 2	21 14 9	11 12	2.5	35 4	20 16 5
Louth. Mrs. Segrave.	14 14	4	35 1½	26 4 5	13 0	4	34 10	22 14 10	14 12	4	35 3	26 1 11
TOTAL.	121 12	36.5		214 6 5	115 9	40		202 19 7	121 15	35.5		215 2 10
AVERAGE.	12 2.8	3.7	35 0	21 8 7	11 8.9	4	34 11	20 5 11	12 3.1	3.6	35 2	21 10 3

Screenings valued at 6d. per stone.

TABLE III.

LARGE SCALE VARIETY EXPERIMENT, 1942. ANALYSIS OF PRODUCE.

GROWER.	Spratt-Archer 37 No. 3.				Archer.				Hybrid 4 B.1 x Golden Archer I.			
			On dry matter				On dry matter				On dry matter	
	Bushel weight lb.	Moisture per cent.	Weight of 1,000 corns. grms.	Nitrogen per cent.	Bushel weight lb.	Moisture per cent.	Weight of 1,000 corns. grms.	Nitrogen per cent.	Bushel weight lb.	Moisture per cent.	Weight of 1,000 corns. grms.	Nitrogen per cent.
Wm. Tait. ...	53.5	19.4	35.0	1.28	54.7	19.4	36.5	1.33	54.2	18.9	38.2	1.38
M. Carroll.	53.7	18.4	36.0	1.24	54.6	18.4	38.6	1.35	55.2	17.7	40.6	1.40
J. Young	52.5	20.0	34.8	1.31	52.7	19.6	35.0	1.40	52.5	19.7	36.2	1.43
D. O'Brien	50.8	21.6	35.4	1.46	52.7	19.2	36.2	1.58	53.4	18.0	39.2	1.62
M. P. Minch.	55.4	17.3	38.7	1.30	57.6	16.6	39.2	1.39	56.4	17.1	40.2	1.50
W. Mullins	53.6	18.0	36.0	1.64	54.6	17.9	37.8	1.65	54.2	17.5	38.0	1.76
M. Howlett ..	52.6	20.4	34.5	1.27	53.4	20.4	35.3	1.32	53.1	20.0	37.1	1.36
P. Byrne.	52.4	19.4	31.0	1.32	53.2	19.8	32.2	1.32	53.9	19.0	35.2	1.35
D. Morris.	54.1	19.0	38.1	1.26	55.3	18.6	38.3	1.31	55.4	18.0	39.5	1.35
Mrs. Segrave.	55.1	18.8	38.0	1.47	54.3	19.8	38.1	1.54	55.6	18.0	41.0	1.58
TOTAL: ..	533.7	192.3	357.5	13.55	543.1	189.7	367.2	14.19	543.9	183.9	385.2	14.73
AVERAGE:	53.37	19.23	35.75	1.355	54.31	18.97	36.72	1.42	54.39	18.39	38.52	1.47

TABLE IV.

HALF-DRILL STRIP EXPERIMENT 1942.

Spratt-Archer 37 No. 3 x Victory 1.	sts.	lb.	Spratt-Archer 37 No. 3.	sts.	lb.
a.	3	7½	B.	3	7½
C.	3	6½	b.	3	7½
c.	3	12	D.	4	5
E.	3	10	d.	3	10
e.	3	13	F.	3	6½
G.	3	7	f.	4	0½
g.	4	0	H.	3	3
I.	3	3	h.	3	9
i.	3	9½	J.	3	9
K.	3	9½	j.	3	11
k.	3	6	L.	3	2½
M.	3	3½	l.	3	5
m.	3	3½	N.	3	2
P.	3	4½	n.	3	2
p.	3	12½	Q.	2	4½
R.	3	1	q.	3	2
r.	3	2½	S.	3	0
T.	3	5	s.	3	4½
t.	3	5	V.	3	6
W.	3	7½	v.	3	5
w.	3	6½	X.	3	5½
Y.	3	3	x.	3	6½
TOTAL	76	12½	TOTAL ..	75	2½
AVERAGE : 48.93 lb.			AVERAGE : 47.84 lb.		
Average Moisture %	19.6			20.3	
Average Nitrogen %	1.31			1.19	
Average weight of 1,000 corns (grms)	37.7			37.1	
Relative Malting Quality	98.8			100.0	

SMALL SCALE QUANTITATIVE EXPERIMENT 1942.

This experiment was conducted in the Cage at the Cereal Station. Eight selections of Spratt-Archer 37 No. 3 were sown in a series of randomised blocks, there being fourteen replications of each variety.

The results set out in Table V show that Spratt-Archer 37 No. 3 Selection VII gave the highest average yield of grain and was significantly superior to the standard variety. The analytical results do not show variations of any account as between the different selections.

TABLE V.

SMALL SCALE QUANTITATIVE EXPERIMENT, 1942.

Average of Fifteen Plots.

VARIETY	No. of Plants	No. of ears	Weight of ears	Weight of Grain	Nitrogen %	Weight of 1,000 corns.	Relative Malting Quality
Spratt-Archer 37 No. 3 1st Pedigree	73.7	155.1	186.8	147.5	1.26	37.2	100.0
do. Selection I.	63.6	144.3	186.4	146.8	1.42	37.0	99.5
do. „ II.	74.5	156.3	187.1	149.1	1.35	37.3	100.2
do. „ III.	67.9	150.1	183.7	145.2	1.33	36.5	100.2
do. „ IV.	69.1	154.5	193.7	153.4	1.40	36.8	101.0
do. „ V.	69.8	156.5	189.3	152.9	1.38	37.3	101.3
do. „ VI.	72	156.7	194.8	156.6	1.35	36.8	100.9
do. „ VII.	81.9	173.7	193.1	160.8	1.34	37.0	101.1

WHEAT.

With the object of providing a suitable stock for distribution in districts where spring wheats are generally sown, extension plots of pedigree Red Marvel wheat were sown on the following farms 1942 :—

Wm. Tait, Buckstown, Rostellan.	....	4 acres.
Wm. Tait, Hermitage, Rostellan	....	8 „

Under the Scheme for the distribution of pedigree Red Marvel seed wheat, stocks of this variety which were produced in the Ballinacurra district in 1941 were distributed to the undermentioned on condition that the produce will be used for further propagations in 1943 :—

Irish Sugar Beet Growers' Association, Ltd., Carlow.
Messrs. W. P. & R. Odlum, Ltd., Portlaoighise.
Messrs. Minch, Norton & Co., Ltd., Monasterevan.

OATS.

Pure Line :—A single plant selection and a garden plot of Black Tartary oats were grown at the Cereal Station in order to retain a pure line stock of this variety.

DEPARTMENT'S EXTENSION PLOTS.

In order to have available stocks of pedigree seed oats for merchants and others interested in the distribution of pedigree seed, stocks of Ardri and Victory II oats were grown under agreement with selected farmers in the neighbourhood of Ballinacurra. These stocks were grown, harvested and threshed under the Department's supervision. The produce was kiln-dried, cleaned and made available for distribution in the spring of 1943.

The following are the names and addresses of growers, together with the acreages and amounts of seed sown :—

ARDRI.

	acres.	brls.	sts.
*Wm. Tait, Buckstown, Rostellan ..	7	8	0
*J. Hegarty, Ballinbeg, Rostellan ..	4	4	8
P. O'Keeffe, Ardra, Rostellan ..	4	4	8
J. Barter, Inchiquin, Killeagh	10	11	6
S. Northridge, Ballymacsliney, Midleton	6	6	12
	31	35	6

*The seed sown at these centres was obtained from the Albert Agricultural College, Glasnevin, Dublin.

VICTORY II.

	acres.	brls.	sts.
Wm. Tait, Hermitage, Rostellan	7	8	0
M. Kelleher, Geragh, Ballinacurra	5	5	10
R. Scanlon, Geragh, Ballinacurra	4	4	8
R. Barry, Broomfield, Midleton	8	9	2
T. Twomey, Ballintubber, Carrigtwohill	5½	6	4
Mrs. Fenton, Killacloyne, Carrigtwohill	3	3	6
T. Canty, Woodstock, Carrigtwohill	4	4	8
	36½	41	10

SCHEME FOR THE DISTRIBUTION OF PEDIGREE STOCKS OF SEED OATS.

Under the Department's Scheme nucleus stocks of pedigree Victory II and Ardri, which were propagated in the Ballinacurra district in 1941, were distributed to Seed Merchants and others in the spring of 1942.

These pedigree stocks were supplied to merchants on condition that they would undertake to have the seed grown by reliable farmers, to purchase the produce, if suitable, and to retain it for seed purposes. In order to facilitate merchants, the Department arranged for the inspection by the Agricultural Instructors of the growing crops. Reports received at the end of the 1942 season indicated that in practically all cases the crops grown from the pedigree seed were likely to produce grain suitable for seed purposes. Consequently, merchants who participated in this Scheme and who took sufficient care in the selection of growers and in the subsequent handling of the produce, have large stocks of high-class home-grown seed oats available for sowing in the spring of 1943.

Under the above Scheme, foundation stocks of pedigree seed oats were supplied to the following in 1942 :—

ARDRI.

The Superintendent, Agricultural School, Athenry, Co. Galway.
The Superintendent, Agricultural School, Clonakilty, Co. Cork.
Messrs. M. Kelleher & Sons, Ltd., Tralee, Co. Kerry.
,, W. Drummond & Sons, Ltd., Dublin.
,, Universal Providing Stores, Edenderry.
,, Latchford & Sons, Ltd., Tralee.
,, Enniscorthy Co.-Op. Agricultural Society, Enniscorthy.
,, E. Dowley & Sons, Ltd., Carrick-on-Suir, Co. Tipperary.
,, J. H. Roche & Sons, Ltd., William St., Limerick.
,, D. E. Williams, Ltd., Tullamore, Offaly.
,, Suttons, Ltd., 1, South Mall, Cork.
,, J. H. Bennett, Ltd., Ballinacurra, Co. Cork.
,, C. F. Bellew Ltd., Drogheda, Co. Louth.
,, M. Rowan & Co., Ltd., Dublin.
,, D. O'Connor, Ltd., Upper William St., Limerick.
,, J. Cunningham, Ballacolla, Laoighis.
,, D. Daly, Earl Street, Mullingar.
,, E. & F. McLysaght, Hazelwood, Mallow.
,, T. McKenzie & Sons, Ltd., Pearse St., Dublin.
,, Donaghmore Co. Op. Creamery, Ltd., Ballybrophy.
,, Shelburne Co. Op. Agricultural Society, Ltd., Campile.
,, J. Callaghan & Sons, Glanworth, Co. Cork.
,, J. Fitzgerald, Drumcollogher, Charleville, Co. Cork.
,, N. P. Cotter, Agricultural Instructor, Roscommon.
,, Irish Sugar Beet Growers' Association, Ltd., Carlow.

VICTORY II.

The Superintendent, Agricultural School, Athenry, Co. Galway.
The Superintendent, Agricultural School, Ballyhaise, Co. Cavan.
The Superintendent, Agricultural School, Clonakilty, Co. Cork.
Messrs. M. Kelleher & Sons, Ltd., Tralee, Co. Kerry.
,, Latchford & Sons, Ltd., Tralee Co. Kerry.
,, J. Callaghan & Sons, Ltd., Glanworth, Co. Cork.
,, H. Good & Co., Ltd., Kinsale, Co. Cork.
,, J. H. Bennett, Ltd., Ballinacurra, Co. Cork.
,, McKenzies, Camden Quay, Cork.
,, Universal Providing Stores, Edenderry.
,, Mitchelstown Co. Op. Agricultural Society, Co. Cork.
,, Enniscorthy Co. Op. Agricultural Society, Co. Wexford.
,, Shelburne Co. Op. Agricultural Society, Ltd., Campile.
,, F. A. Waller & Co., Ltd., Banagher.
,, E. Dowley & Sons, Ltd., Carrick-on-Suir, Co. Tipperary.
,, D. E. Williams, Ltd., Tullamore, Offaly.
,, Rowan & Co., Capel Street, Dublin.
,, W. Drummond & Sons, Ltd., Dublin.
,, J. P. Hopkins & Sons, Ltd., Wicklow.
,, D. Daly, Earl Street, Mullingar.
,, G. Byrne, Bree, Ballyhogue, Enniscorthy.
,, J. H. Smyth, St. Johnston, Co. Donegal.
,, Irish Sugar Beet Growers' Association, Ltd., Carlow.

The Albert Agricultural College co-operated with the Department in the working of the foregoing scheme, and stocks were distributed as follows :—

GLASNEVIN SUCCESS.

J. H. Bennett, Ltd., Ballinacurra, Midleton, Co. Cork.
Jeremiah Milner, Ballineen, Co. Cork.
Mrs. Drummond, Rathaldron Castle, Navan, Co. Meath.
Major E. M. Connolly, Castletown, Celbridge, Co. Kildare.
Agricultural School, Athenry, Co. Galway.
Agricultural School, Ballyhaise, Co. Cavan.
Agricultural School, Clonakilty, Co. Cork.

ARDRI.

The Cereal Station, Ballinacurra, Midleton, Co. Cork.
Patrick O'Neill, Ballintee, Dunamaggin, Co. Kilkenny.
T. Lucey, Sillogue Farm, Gibbstown, Co. Meath.
L. Kavanagh, Balkinstown, Nurney, Co. Kildare.
T. Brophy, Ballygurteen, Castlewarren, Co. Kilkenny.
R. O'Brien, Hill House, Tinny Cross, Tullamore, Offaly.
J. S. Leonard, Balloy, Stamullen, Co Meath.

POTATO (ARDEE).

Agricultural School, Athenry, Co. Galway.

OATS HALF-DRILL STRIP EXPERIMENT.

In this experiment which was carried out on the farm of Messrs. John H. Bennett, Ltd., Ardri was tested against Victory II. The trial consisted of twenty-two strips of each variety, a strip being half the width of the corn drill. To ensure even sowing, the seed in each half of the drill was changed over for the sowing of the second half of the experiment.

The results which are set out in Table VI show that Ardri gave a slightly higher average yield than Victory II, the difference was not, however, significant.

TABLE VI.

OATS HALF-DRILL STRIP EXPERIMENT, 1942.

VICTORY II.	sts.	lb.	ARDRI.	sts.	lb.
a.	2	10	B.	2	11½
C.	2	11	b.	2	11½
c.	2	9½	D.	2	5½
E.	2	7½	d.	2	9½
e.	2	10½	F.	3	1
G.	2	7½	f.	2	8
g.	2	8	H.	2	11½
I.	2	6½	h.	2	12½
i.	2	5½	J.	2	5
K.	2	3½	j.	2	7
k.	2	4½	L.	2	0
M.	2	7½	l.	2	7
m.	2	2	N.	2	6½
P.	2	5½	n.	2	2½
p.	2	1½	Q.	2	9
R.	2	5½	q.	3	0½
r.	2	0	S.	2	0
T.	2	5½	s.	2	9
t.	2	9½	V.	2	10
W.	2	3½	v.	2	5½
w.	2	4½	X.	2	0
Y.	1	13	x.	1	12½
TOTAL:	53	2	TOTAL:	55	5½
AVERAGE:	33.82 lb.		AVERAGE:	35.25 lb.	

FLAX.

At the Cereal Station, Ballinacurra, extension plots of the following linseed varieties were grown:—

Bison, Buda, Redwing, Newlands, Rio, Argentine Linseed, Boley Golden, and for comparison with these from the point of view of seed production the following fibre varieties were also grown:—Liral Prince, Liral Crown and Concurrent.

CHARACTERISTICS OF SOME IRISH ORCHARD SOILS IN RELATION TO APPLE TREE GROWTH

BY

THOMAS WALSH, Ph.D., M.Agr.Sc., and EDWARD J. CLARKE, B.Agr.Sc. (Hort) (University College, Dublin)

INTRODUCTION

Although the apple has been cultivated in private gardens in Ireland for centuries, the first real attempt to develop fruit production on a commercial scale was that made in 1904. In that and subsequent years, a number of trial orchards were laid down at selected centres, the principle of planting being that followed in Kent, England, and the varieties used were Bramley's Seedling, Newton Wonder, Lane's Prince Albert, Early Victoria, Allington Pippin, Worcester Pearmain and Beauty of Bath. While some of these trial orchards were laid down in an unsuitable environment and although some others were greatly neglected, proof was produced that the commercial production of apples in this country was a feasible proposition. In the intervening years a considerable extension in fruit growing has taken place, most attention being devoted to the planting of culinary varieties. As a result of this the position to-day is such that the domestic need for cooking apples is practically satisfied over the period August to March (and if storage facilities were improved capable of being satisfied for a considerably longer period), while the home production of dessert apples is altogether inadequate to meet our normal requirements in this respect.

This concentration on the growing of culinary apples, mainly Bramley's Seedling in the past appears in part attributable to the fact that this variety especially, on account of its vigorous constitution did very well in the great majority of orchards, and in part to the assumption which dominated in orcharding until relatively recently that it was impossible to produce dessert apples in this country of a quality capable of competing with imported fruit. Now-a-days, however, it is realised that when sufficient attention is paid to certain factors of prime importance dessert apples of a quality second to none can be produced economically here. To achieve this, it is essential to realise that the successful cultivation of apples is a highly specialised job involving many considerations as to suitability of location, soil type, manuring and treatment.

Other factors of major significance such as climate, aspect and topography being favourable the nature of the soil is of predominant importance in determining productivity. Consequently, orchard planting involving as it

does considerable expenditure of money and energy over a long cropping period necessitates the most efficient possible utilisation of soil resources. No matter how suitable other conditions may be, if the soil at planting time is of such a nature as to inhibit healthy growth, disappointing results must necessarily ensue. The fact that a soil may produce farm crops successfully, does not by any means indicate that it is suitable for orchard planting, where depth of soil, physical condition and nutrient status throughout the region of root penetration are of such fundamental importance. In the utilisation of Irish soils for fruit production in the past, this does not by any means appear to have been fully appreciated as there is little doubt that if it had, there are many existing orchards which would never have been planted, and many highly productive ones adorning sites at present, not utilised, but highly suitable for this purpose. While apples of superb quality are produced in abundance in some orchards, there are others which either yield very inconsistently or produce fruit of inferior quality. In many instances, also the productive life of apple trees has been uneconomically short. These instances of bad husbandry are invariably attributable to either planting unsuitable sites or subsequently treating as regards manuring in a manner inconsistent with the nutrient demands of the trees and the nutrient supplying relationships of the soil. Lack of information as to the inherent qualities of our soils conducive to satisfactory growth and productivity has indeed been very detrimental to successful orcharding in this country.

Recent policy with regard to apple production here seems to lie in the direction of making ourselves self-supporting over the longest possible period with regard to both culinary and dessert apples. Schemes aimed at obtaining a considerable extension of the area under fruit with this object in view have been inaugurated in recent years. In order to avoid as far as possible the mistakes made in the past there is an obvious need before any such extension can be confidently embarked on to make available to all interested information as to the soil types most suitable, and the manurial practices in relation to such soil types which are most efficient for the purpose. In some countries detailed attention has been devoted to the collection of such information and has according to various authorities on the subject proved invaluable in placing soil utilisation in fruit production on an efficient ordered basis.

The work being reported on in this paper has ensued as a result of a preliminary survey designed to investigate the relationship of apple tree growth to soil type in some Irish orchards. It is hoped eventually to provide information which will serve as a guide to prospective orchardists and prove a means of assisting present growers towards better crops.

Methods of Investigation: By the interpretation of data derived from soil and pomological surveys carried out on existing orchards of known history as regards planting and management, a logical means is available

to enable the segregation of those factors of most importance in contributing to bad growth, failure and certain physiological expressions of malnutrition on the one hand, and good growth and success on the other. In the autumn of 1941, a number of orchards in the counties of Kilkenny, Waterford and Tipperary were visited. The orchards examined were on soils of different geological formations and consequently varied appreciably as to fundamental type. Unfortunately, the soils in the areas surveyed had not previously been classified and consequently, the work to be carried out involved supplying information in this respect. However, field examination revealed a close relationship between many of the soils examined and those described as "Brown Limestone" and "Brown Earth" by Gallagher and Walsh (2). This was further verified on analysis. No soils of the Podsol class were encountered. Various aspects of tree growth vigour such as height, branch spread, foliation, and fruiting ability both as regards quality and quantity, were recorded. Particular attention was devoted to foliage examination for the detection of symptoms indicative of nutrient deficiency. Unfortunately, due to limited facilities it was found impossible to obtain a complete picture of tree vigour as measured by detailed records of extension growth and root development. The utility of such information has been amply demonstrated by many investigators and is of particular significance when considering the type of root stock most suited to apple varieties in different soils. It is hoped to have an opportunity of investigating this aspect of the problem at a later date.

Field Study of the Soils: The thorough examination of the soil of any one orchard demanded in the first instance a preliminary survey of the area to determine any significant variations which might be present. This was followed by the digging of a pit in a situation selected as representative in order to expose for examination a soil profile. As most of the orchards were of limited size in only very few instances was any significant lack of uniformity in the soil in any one plantation noticed. While it would have been very desirable to have excavated the pit to a considerable depth in order to make a complete record of all the significant features of the profile (in addition to recording root distribution) it was found that soil type could be sufficiently well identified for the purpose of the investigation by the presence of certain distinctive characteristics when an excavation of some 2′ to 3′ was made. Subsequent examination was carried out and appropriate notes recorded according to the procedure described in a previous issue, of this Journal by Walsh (7), such features as colour, structure, texture, drainage properties and distribution of calcium carbonate (if any) receiving particular attention. Wherever possible data as to the relation of the orchard soil to the type of general distribution in the district, through the examination of profiles exposed in quarries, embankments, etc., was obtained.

Methods of Sampling and Analysis: Soil sampling being carried out with two main objects i.e. (a) to enable characterisation as to fundamental

type; (b) to allow of the assessment of available nutrients, total nitrogen, carbon, pH etc., both throughout the profile and for the surface soil of the orchard as a whole, it had to be varied according to these demands. Where the profile was divided into "horizons," each horizon was sampled individually. Most of the soils investigated were not so divided however, being of the "brown limestone" or "brown earth" types. These were sampled by taking samples from each successive 6" (or other appropriate) section of the soil the depth of sampling etc., being evident from the results recorded in the tables herein presented. Sampling of surface soils for the purpose of determining general nutrient status etc., and for some other special purposes as indicated later was carried out as described by Walsh (7).

After conventional treatment of the soil samples as to drying and sieving on reaching the laboratory, appropriate physical and chemical analyses were, with a few exceptions, carried out in accordance with recognised procedures. The physical determinations made consisted of mechanical analysis by the method proposed by the Agricultural Education Association in 1927 stones and gravel being recorded as to amount present and geological nature. As assistance for carrying out analysis was very limited it was only found possible to study the mechanical composition of a selected sample from each profile but as no material differences throughout each profile in this respect were evident the results can be considered representative.

Structural stability was investigated according to the procedure utilised by Gallagher and Walsh (3) in studying the state of flocculation of some Irish soils. This latter method consisted of shaking a quantity of air-dried soil (< 2 mm.) with carbon dioxide free water in such proportion as correspond to a 2 per cent. dispersion of the soil, for 40 hours, after which samples for silt and clay were withdrawn as in mechanical analysis. In addition, the effect on flocculation of carbon dioxide was carried out in a similar manner by treating carbon dioxide free suspensions with this gas for 5 minutes, and subsequently sampling as above. "Clay Fraction" separation and analysis was carried out as described by Gallagher and Walsh (2) and the results presented in a similar manner. It should be noted that the ratios derived from these results are molecular ratios. In soil type characterisation it is universally recognised that analyses carried out on the clay fraction of soils are of fundamental importance. This arises from the fact that the effects of weathering are mainly reflected in the constitution of this fraction. Moreover, it is the seat of many vital reactions concerned with the absorption and release of nutrients, in addition to exerting a profound influence on soil structure. While in general all the samples of a profile down to the depth of sampling were subjected to study in this way in a few instances, only one sample selected as representative was analysed. This is evident in the text.

Assessment of Nutrient Status: In determining the nutrient status

of a soil for the purpose of growing an ordinary agricultural crop it is usual to devote main attention to the surface soil to a depth of some 6-9". As apple tree roots penetrate deep into the ground it is obvious that much of their nutrient supply will be drawn from the lower or subsoil region of the profile and hence, the nutrient supplying power of this sphere is of considerable importance. Consequently, in this study attention was devoted to the assessment of the nutrient status both in selected surface samples and throughout each profile. The method adopted for this purpose was that of Morgan (4) modified for the determination of phosphate as suggested by Walsh (7). Various aspects of the efficiency with which this procedure enables a knowledge of the available nutrients in Irish soils to be obtained have been discussed previously (7), when it was concluded that in this manner very valuable data can be collected. At an early stage in this investigation it became apparent that the physiological condition of apple tree foliage known as "leaf scorch" was of considerable importance in many orchards. In devoting some special attention to this condition the relation of the incidence of scorch to the question of the fixation of potash in an unavailable form in the soil both as occurring naturally and as accentuated by drought, was deemed worthy of study. The potash immobilising power of a number of soils was determined by treating 10 grm. of air-dried soil (<2 mm) with 5 c.c. of a .112 per cent solution of potassium sulphate i.e. equivalent to manuring at the rate of 10 cwt. per acre. After thorough mixing, soil and solution were allowed to remain in contact for some time, extraction with 15c.c. Morgan's Solution and estimation of potassium in the extract being then proceeded with. In a few instances some of the soils after treatment relative to manuring as above, were dried on the water bath, re-wetted with distilled water and dried again, this being repeated three times. After extracting according to Morgan's (4) technique, the effect of drying on potash immobilisation was recorded. In addition the ability of some of the soils under investigation to fix potash in a water insoluble form has received attention. To achieve this 10 grm of soil ($<$ 2 mm) were treated with 20 c.cs. of a .028 per cent. solution of potassium sulphate. After mixing thoroughly and allowing to stand for some time filtration was carried out and the amount of potassium in the filtrate determined. The difference between the concentration of potassium in the original solution and filtrate represented the amount absorbed. The results from these studies are presented in Table II, and are essentially of but a preliminary nature.

General Analysis: Nitrogen was estimated on selected samples by the Kjeldahl method, carbon by the wet combustion method as modified by Dixon (1). pH by the quinhydrone electrode, calcium carbonate on material of $<$ 1 mm diameter by the use of Collins calcimeter and such other data as are recorded in the text by usual methods. Organic matter was calculated by multiplying the percentage carbon by the conventional factor of 1.724.

Presentation of Results: In recording soil and pomological data, the orchards visited have been named according to county. The following list is an index to the orchards, their general location and the numbering of the soil samples collected:

County	District	Orchard No.	County	District	Orchard No.
Kilkenny	Gowran	K.1	Tipperary	Knocklofty	T.2
,,	,,	K.2	,,	,,	T.3
,,	Thomastown	K.3	,,	Ardfinnan	T.4
,,	Knocktopher	K.4	Waterford	Ballyduff	W.1
,,	Piltown	K.5	,,	,,	W.2
,,	,,	K.6	,,	,,	W.3
,,	,,	K.7	,,	,,	W.4
,,	,,	K.8	,,	,,	W.5
,,	,,	K.9	,,		
,,	,,	K.10	,,	Dungarvan	W.6
Tipperary	Knocklofty	T.1	,,	,,	W.7

In presenting results for nutrient status determinations the following system of abbreviation has been adopted:—

< EL = Less than Extra Low EL = Extra Low VL = Very Low L = Low
M = Medium MH = Medium High H = High VH = Very High
EH = Extra High

In recording the results for Phosphate status the figures in brackets thus VL (12) indicate the amount in lbs. per acre of available P_2O_5 present i.e. in this instance 12lbs. per acre. In addition to the above manganese has been recorded as

Neg. = Negative (less than 2 lbs. per acre).
Tr. = Trace (2 lbs. per acre) and
Tr. = (approximately 3 lbs. per acre).

ORCHARD K.1. (GOWRAN DISTRICT).

This orchard of some 23 acres in area was planted about the year 1903, the varieties used being Bramley's Seedling, Lane's Prince Albert, Lord Derby, Newton Wonder, Gascoyne's Scarlet, Allington Pippin, Worcester Pearmain and Blenheim Orange. The trees are of bush and half standard forms and are probably on crab stock. With the exception of some thinning out routine pruning was not practised. Winter and scab sprayings were followed according to usual procedure. With the exception of one portion (western) which prior to being laid down to grass some 12 years ago was inter row-cropped with mangels and

potatoes, this orchard has been in grass since planting, the herbage which is of a rather inferior type being removed through grazing and mowing. Manuring mainly consisted of the application of a total of 12-14lbs. of sulphate of potash per tree applied in three or four dressings over a period of eleven years, the last application taking place some four years previous to our visit.

POMOLOGICAL OBSERVATIONS.

Tree Growth: Stunting was general and severe, some varieties being much more deleteriously affected in this way than others; Worcester Pearmain and Lane's Prince Albert in particular being very much undersized. In this connection also differences were evident in different parts of the plantation, growth being somewhat better in the central than in the eastern and western sections with the exception of the variety Gascoyne's scarlet in the latter (which had been manured with dung each year). On an area of some 2-3 acres, where drainage was impeded, growth was particularly bad, many trees having completely failed.

Lack of vigour was particularly well reflected in the extent to which young growth had developed, being practically negligible in Worcester Pearmain and Lane's Prince Albert, very weak in Allington Pippin and subnormal for Bramley's Seedling. The only variety exhibiting growth approaching normal, except in the case of the preferentially manured Gascoyne's Scarlet indicated previously, was Lord Derby.

Foliage: Probably the most striking feature of the foliage of practically all trees in the plantation was its sparseness, much bare wood being evident everywhere. Moreover, with few exceptions, the leaves were of a yellow-green colour, being considerably reduced in size, poor in quality and quantity. The outstanding exception in this case was the variety Gascoyne's Scarlet when treated as previously intimated. In no instance, was typical "leaf scorch" developed, though some bronzing generally accompanied by irregular blotching was apparent on the foliage of a few trees of Lane's Prince Albert. Premature defoliation was severe and general, this again being particularly marked on Worcester Pearmain and Lane's Prince Albert, mere tufts of leaves remaining at shoot tips of the great majority of trees. Allington Pippin and Bramley's Seedling were also very badly affected in this respect, trees of the latter variety in one part of the orchard being practically denuded of foliage. Generally, throughout the plantation spray injury to foliage was marked.

Cropping: An outstanding feature of the fruit in this orchard was the extent to which colouring had taken place even Lord Derby, which is normally quite green, developing a distinct red colour. Worcester Pearmain fruits were of a brilliant red hue and of sweet flavour while Lane's Prince Albert was also exceptionally highly coloured. Considerable reduction in the size of fruit was however, obvious and the yeild in this (1941) season was very small.

In general, it was apparent that cropping potential was low due to (a) a definite tendency towards dying off of spurs on the older parts of the trees and (b) to the production of puny undersized fruit buds which were inclined to shrivel and die off, particularly on the older wood. On many trees only wood of two and three years old was productive.

General: Of the culinary varieties Lord Derby (in particular) and Newton Wonder reacted best under the existing conditions. Lane's Prince Albert responded badly while Bramley's Seedling occupied an intermediate position. It was very obvious that the dessert varieties Allington Pippin and Worcester Pearmain reacted very unfavourably to the existing growth conditions. Diseases such as canker and scab were notably absent though some trees were badly covered with lichens.

SOIL.

The parent material of this soil is mainly drift derived from Carboniferous formations the under-lying rock being Lower Carboniferous Limestone. At present the stones and gravel found in the surface three feet of soil reflect this geological origin, being composed of carboniferous shale, flint, grit, and limestone with some quartz. Preliminary examination revealed the existence of one main soil type over the whole area though this varied somewhat according as drainage was free or impeded. The normal soil developed under conditions of relatively free drainage is of a grey brown colour to a depth of 2½′ below which it takes on a somewhat blue hue. Very little difference in colour is evident between surface and subsoil, the latter, however, becoming somewhat more brown at a depth of 1½′. Texture is reasonably uniform throughout, stones and gravel being present in considerable quantity. The general topography is moderately undulating, slight depressions where the soil shows evidence of water logging, occurring in some instances. Where this does occur it would appear to be not so much due to the impermeability of the soil as to lack of facilities to carry off the surplus water. In digging this (normal) soil it was noted to be very hard. Samples were taken in depths as indicated in the text, this profile being described as Profile (a), and its location a grass patch continuous with the main orchard.

As mentioned previously, some 2.3 acres of this orchard is occupied by a soil showing evidence of bad drainage. Though situated in a slightly depressed position, the topography of this area is not very noticeably different from that of the orchard in general. The surface soil of some 7″ in depth is of a blackish grey-brown colour with no distinctive structure. As compared with the normal surface soil of the orchard, the difference in colour is quite distinct. Below this surface soil is a "gley" horizon, in which the soil is of a somewhat grey colour through which are interspersed rusty brown specks. In some parts of this badly drained area, this horizon is of a somewhat more grey-brown colour than that described above, this being particularly obvious near the junction with the normal type, though mottling still persists. This horizon has a rather compact structure and

on the average is some 9″ in depth. Below a depth of 16″ the soil is of a blue-grey colour, of compact structure and rather stoney, the majority of the stones present being limestone. All evidence points to the existence of a high fluctuating water table in this region. Sampling was carried out at the depths indicated in the foregoing, the profile of this area being recorded as Profile (b).

In addition to the sample taken as above some others, mainly composite surface samples were collected for the purpose of nutrient and general fertility assessment. The results of all the analyses are presented in the following:

Mechanical Analysis:

Profile	Sample	Clay	Silt	Fine Sand	Coarse Sand	$CaCO_3$	Hyg.H_2O	Loss in Solution
		%	%	%	%	%	%	%
(a)	12″—22″	24.4	21.8	37.2	14.1	Tr.	2.4	0.7
(b)	7″—16″	15.0	12.5	34.5	32.2	2.0	1.4	1.0

Clay Fractions:

Profile	Sample	Ignition loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
(a)	0″—6″	13.86	47.18	22.52	9.83	0.71	2.8	3.6	12.7	3.6
	6″—12″	13.14	46.94	23.77	10.10	0.68	2.7	3.4	12.4	3.7
	12″—22″	10.48	45.54	26.35	11.19	0.58	2.3	2.9	10.8	3.7
	22″—30″	10.62	44.68	26.26	10.56	0.58	2.3	3.0	11.3	3.9
(b)	0″—7″	21.21	46.86	19.84	6.10	0.62	3.3	4.0	20.0	5.0
	7″—15″	11.10	47.96	22.01	10.65	0.60	2.8	3.6	12.1	3.4
	15″—30″	13.16	44.24	19.73	9.01	0.56	2.9	3.8	13.1	3.5

General Analysis:

Sample	Type	Sample	Hyg H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
Profile	(a)	0″—6″	2.7	6.6	3.41	0	1.98	0.20	9.9
,,		6″—12″	2.2	6.3		0	—	0.08	—
,,		12″—22″	2.4	7.0		Tr.	—	0.03	
,,		22″—30″	2.2	7.1		.20	—		
,,	(b)	0″—7″	2.4	6.3	5.53	0	3.21	0.35	9.1
,,		7″—15″	1.4	7.0		2.00	—	0.05	—
,,		15″—30″	1.0	7.5		18.90	—	—	—
Surface	(East)	0″—6″	2.4	7.2	4.19	.05	2.49	0.12	20.7
Subsoil	(Do.)	6″—18″	2.0	6.8		0	—	.05	
Surface	Comp. (a)		2.7	6.7	4.14	Tr.	2.45	.16	15.4
Surface	Comp. (b)		2.4	6.4	5.55	0	3.22	.18	17.9

Nutrient Status:

Sample	Type	Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
Profile	(a)	0″—6″	VH	M	VL(8)	<EL	H	M	Neg.	M
		6″—12″	VH	L	VL(8)	<EL	H	M	Neg.	M
		12″—22″	MH	L	VL(16)	<EL	H	MH	Neg.	M
		22″—30″	VH	M	VL(12)	EL	VH	MH	Tr.	M
Profile	(b)	0″—7″	VH	M	EL(4)	L	H	M	Tr.	M
		7″—15″	H	M	EL(4)	<EL	H	M	L	M
		15″—30″	H	M	EL(2)	<EL	EH	MH	H	MH
Surface		0″—6″	M	H	VL(12)	<EL	H	M	Neg.	M
Subsoil		6″—18″	MH	L	VL(16)	<EL	MH	MH	VL	M
Surface		Comp. (a)	MH	L	VL(8)	<EL	H	MH	Neg.	M
Surface		Comp. (b)	L	MH	VL(16)	M	MH	M	VL	MH

The results presented above indicate a medium loam soil very closely related to the brown limestone type of Gallagher and Walsh (2) though the SiO_2/R_2O_3 ratio is somewhat lower than that typical for this group. From the analysis of clay fraction, it is apparent that some leaching has proceeded in the normal well-drained phase, the ratio decreasing considerably with increasing depth. It is of interest in this connection that a profile typical of the Athy phase (2) of the brown limestone type was identified some distance away. A striking example is afforded here of the uselessness of planting a soil subject to drainage impedence. There is little doubt that with appreciation of the way in which bad-drainage is expressed in soil development the planting of this portion of the orchard would have been avoided.

From the aspect of suitability as a medium for healthy root development which is of course, essential to normal growth and productivity of trees, the general soil type occurring here is by no means ideal. This arises not so much from its textural as from its structural features. It is a soil which is rather compact and difficult to dig with no tendency towards that friability which is associated with well developed crumb-structure. This is no doubt, associated with the presence of a relatively high content of easily dispersible clay fraction (see data in this respect presented at a later stage)

The general and nutrient analysis reveal a very low state of fertility, this being associated not with any deficiency of organic matter but with low status as regards nitrogen and potash. With reference to the observations on tree growth cropping etc., recorded previously, the analytical results are of considerable interest in so far as they provide an explanation for the reactions noted. It is universally appreciated that stunting, sparseness and yellowing of foliage, premature defoliation, high colour, and reduced size of fruit are related to nitrogen starvation. The analysis show that the nitrogen content of the surface soil in locations where these symptoms obtain is low (see surface composite samples (a) and (b). Moreover, the

ratio of carbon/nitrogen is wide such a wide ratio being generally a feature of infertile soils (the carbon/nitrogen of normal fertile soils is generally in the 10-12 region whereas in this instance, it reaches as high a figure as 20.7). Nitrification is not completely inhibited however, though it should be realised that the figures for "nitrate" and "ammoniacal" nitrogen in nutrient analysis have been obtained on samples far removed from natural environment, where such factors as aeration, moisture, etc., play an important part in regulating bacterial activity. Under the conditions (grass) present in this orchard the apple trees will not only have to compete with bacteria for any available nitrogen but also with the grasses present in the herbage, and consequently, the reasons for the accentuated nitrogen starvation of the trees in this orchard are apparent.

While the potash status of this soil is in the main extremely low, the fact that typical "leaf scorch" is not manifested (though some other conditions usually attributed to lack of this nutrient are evident) is no doubt either associated with the fact that small dressings of potash manures have been applied, or that in the absence of sufficient nitrogen, tree growth has not been sufficiently vigorous to accentuate the deficiency. In this connection it should be realised that nutrient balance is of prime importance, especially when any nutrient is in a quantity approaching deficiency, in determining growth vigour i.e. trees growing on a soil of high nitrogen and low potash status have been shown (5) to be much less vigorous than those growing on a soil low in both nutrients. At a later stage in this paper some data are provided as to the interaction between this soil type and potassic fertiliser, when it is shown that immobilisation of potassium must be considered when determining the quantity of such a manure desirable to apply.

The analysis reveal that the available phosphate content is not materially different (though somewhat higher) than that of many old pastures found in this country. There is not by any means complete deficiency, though the position in this respect is not at all as satisfactory as it might be. With the exception of the element manganese, the status of this soil with regard to the other elements for which data are presented appears sufficiently high. Obviously, there is no need for lime. Indeed, the fact that the subsoil in general is somewhat calcareous and alkaline may in itself be a rather undesirable feature as under such conditions there is greatest tendency for deficiency of such essential elements as iron, manganese, boron and zinc to arise.

Finally, it seems justifiable to observe that while this soil is not an ideal one for orcharding, proper attention to manuring and culture in the past would have contributed to the development of a much more productive orchard than that which at present exists.

ORCHARD K.2. (GOWRAN DISTRICT).

Planted in 1908, this orchard which covers an area of some

5 acres is situated in close proximity to K.1, being on the same soil type and treated (with the exception of one small portion) in a comparable manner. Bramley's Seedling, Lane's Prince Albert, Newton Wonder, Bismarck, Gascoyne's Scarlet, Allington Pippin, and Lord Derby are the main varieties present. There is no record of this orchard having been otherwise than at present, i.e. in grass. Manuring with potassium sulphate at the rate of about 6 pounds per tree applied in three dressings during the eight years preceding our visit has taken place. One portion in addition received liberal dressings of farmyard manure. The trees are on crab or free stocks.

POMOLOGICAL OBSERVATIONS.

Tree Growth: From this aspect two well defined divisions are obvious in this orchard. (1) Part of the orchard showing tree growth very comparable to that noted for K. 1. (2) Part showing much better growth—this being that portion which has received dung. While in K 1. and division (1) Lane's Prince Albert has an average height and spread of 10′ and Bramley's Seedling corresponding dimensions of 16′ and 17′, the former variety in Part (2) has dimensions of 16′ and 17′ and Bramley's Seedling 30′ and 30′, annual growth in addition being quite satisfactory. Besides, the foliage is abundant, of a light green colour with fruit buds numerous and plump, while the trees in ground not top-dressed with dung display all the undesirable characteristics described for K 1.

SOIL.

As remarked previously the soil in this orchard is of the same general type, though some interesting differences exist between parts (1) and (2) above In part (2) the surface soil to a depth of about 8″ is of a more blackish grey-brown colour, with a subsoil of well developed structure which is not by any means so compact or so difficult to penetrate with an auger as the soil in K 1. or part (1). In the latter the surface soil to a depth of 8″ is of grey-brown colour, this being underlain by a rather grey-blue layer of approximately 3″ in depth and being succeeded in turn by compact soil showing much iron-staining and small brown-black nodules (probably manganese). Some general and available nutrient analyses in samples taken from this part of the orchard are recorded in the following; profile samples being taken at depths indicated in the foregoing. No samples were taken from the area showing good growth as it was thought that the manurial treatment carried out offered a sufficient explanation for the differences discussed.

General Analysis:

Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
0″—8″	1.5	6.6	4.48	0	2.60	.15	17.3
8″—11″	1.5	6.7	—	0	—	.07	—
11″—24″	2.2	7.1	—	.01	—	.06	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
0″—8″	L	M	VL(8)	EL	MH	MH	Tr.+	MH
8″—11″	M	M	VL(12)	EL	H	MH	Tr +	M
11″—24″	L	M	VL(16)	<EL	H	M	Tr.+	M

These analyses reveal a position closely akin to that reflected in those of soil samples from Orchard K. 1.

ORCHARD K. 3. (THOMASTOWN DISTRICT).

An orchard of one acre in area situated on the side of a rather steep slope in an exposed position. As the trees (vars. Bramley's Seedling, Laxton's Superb, Ellison's Orange and Worcester Pearmain) were but recently planted (2 years) very little data as to growth behaviour was available. Cultivation has been proceeded with since planting, lime and potash having been applied to the soil in the tree rows. Stocks of the crab type were probably used. Pomological observations revealed that no variety was making good growth, Laxton's Superb and Ellison's Orange showing "leaf scorch."

SOIL.

The surface soil of this plantation is of brown colour, possessing a fairly well-developed crumb-like structure while the subsoil is of a more yellow brown hue, and more compact. As might be expected no appreciable soil-type variations occur over the area. Below a depth of about 18″ the soil becomes very stony, the stones being predominantly silurian shale. It is in fact, a rather shallow soil. Drainage is good and probably excessive. Samples for analysis were drawn from the surface 6″ and the underlying 10″, the tree row region being avoided in doing this.

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution
6″—16″	12.3	19.4	23.4	41.1	0	1.4	0.6

Clay Fractions:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
0″—6″	17.76	41.04	25.73	8.21	.50	2.2	2.7	13 4	5.0
6″—16″	12.78	41.87	25.86	12.56	.56	2.1	2.7	8.8	3.2

General Analysis:

Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
0″—6″	2.6	5.7	4.57	0	2.65	0.13	20.4
6″—16″	1.4	5.6	—	0	—	0.09	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
"0—6"	H	L	VL(12)	L	M	L	L	H
"6—16"	M	L	VL(12)	<EL	VL	L	Neg.	M

These analyses substantiate the field observations in classifying this soil as of the Brown Earth type (2). The fact of being shallow though texturally a light loam with favourable structure points to unsuitability for fruit growing. The analyses reveal a low nutrient supplying capacity, potassium in particular being deficient. This is reflected in the incidence of leaf scorch. It might however, from data provided elsewhere in this report, be inferred that any potassic manure applied would in great part be available for plant use as the potash immobilising power of this soil is shown to be negligible.

ORCHARD K. 4. (KNOCKTOPHER DISTRICT).

This one acre orchard was planted in the year 1938, the varieties Bramley's Seedling, Monarch, Allington Pippin, Laxton's Superb, Worcester Pearmain, and Cox's Orange Pippin being used. It has been under cultivation since planting. The trees had up to time of visit received two moderate applications of sulphate of potash. They are of the bush and half standard form being on stocks of unknown type. Regular spur pruning has been practised.

POMOLOGICAL OBSERVATIONS.

Tree Growth: All varieties were making good growth this being particularly well reflected in the length of extension shoots, which were approximately as follows: Laxton's Superb 4′, Allington Pippin 3½′, Cox's Orange Pippin and Bramley's Seedling 3′, Worcester Pearmain and Monarch 2½′. Another striking feature of tree reaction in this plantation was, that despite vigorous growth, spurring, even in the instance of Bramley's Seedling and Worcester Pearmain (which are inherently shy in this respect in their early years was taking place quite freely. While canker was absent, scab was rather general.

Foliage: The leaves were of a dark green hue and of good quality. In some instances, leaves of Cox's Orange Pippin showed marginal scorch while in addition an interveinal metallic-grey bronzing was observed on

some leaves of this variety and to some extent also on those of Laxton's Superb, Allington Pippin, and Monarch. The foliage of a few Cox's Orange Pippin trees showed a brown nocrotic spotting.

Cropping: Cropping potential was high as indicated by well developed fruit buds and free spurring.

SOIL.

The topography of this site is of the gently rolling type with a slight slope towards the north east. No variations from the soil type discussed below were encountered. With the exception that the surface soil to a depth of about 6″ is of a somewhat darker colour than the underlying subsoil, there is relatively little differentiation throughout the profile. From 6″-18″ the soil has a good brown colour which lightens somewhat deeper down. The structure is good throughout being of the well-developed crumb type and drainage is excellent. At a depth of about 5′ the soil becomes gravelly in texture this no doubt, contributing very materially to the excellence of the drainage. In the 6″-12″ region of the profile small lime-spots are evident, it being interesting in this connection to note that this land had been heavily limed, over 100 years previously. The nature of the stones and gravel present point to the parent material (drift) as being of mixed origin and probably in the main influenced by the Silurian, Sandstone and Carboniferous formations outcropping in the neighbourhood.

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution %
12″—18″	17.8	20.2	44.1	14.5	0.2	1.6	0.7

Clay Fractions:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
0″—6″	20.61	41.77	20.70	7.91	0.52	2.7	3.4	14.2	4.2
6″—12″	15.80	41.38	23.22	9.63	0.58	2.4	3.0	11.6	3.8
12″—18″	14.66	43.52	23.34	9.16	0.38	2.5	3.1	12.7	4.0
18″—30″	12.02	41.88	26.55	11.98	0.59	2.1	2.7	9.3	3.5

General Analysis:

Sample	Hyg. H_2O %	pH	Organic Matter	$CaCO_3$ %	Organic Carbon	Nitrogen	C/N
0″—6″	3.1	7.0	10.15	0.13	5.89	0.24	24.5
6″—12″	2.0	7.1	—	1.30	—	0.13	—
12″—18″	1.6	7.4		0.20	—	0.09	—
18″—30″	0.9	7.5	—	0.12	—	—	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
0″—6″	M	L	VL(12)	EL	H	MH	Neg.	M
6″—12″	VH	M	EL(4)	<EL	H	L-M	Tr.	M
12″—18″	VH	L	EL(4)	EL	H	L-M	Neg.	M
18″—30″	M	L	VL(8)	EL	H	M	Neg.	MH

These analyses indicate that this soil while not a true Brown Earth closely approaches that type in some essential features. That the position should be thus is appropriate, considering that while the drift has been largely influenced by the Silurian and Old Red Sandstone formations of the neighbourhood, it has also been affected by Carboniferous formations. This soil may indeed be regarded as something of a transition type between the Brown Earth and Brown Limestone of Gallagher and Walsh (2).

From the aspect of physical construction it should constitute an excellent soil for fruit growing and this has been amply reflected in the results obtained to-date. Of a medium loam texture and with a structure conducive to good aeration and permeability this soil should prove a good medium for healthy root growth. In relation to structure it is noteworthy that while the total clay fraction content is some 18 per cent. there is a relatively small amount of easily dispersible clay present (see Table I) the structural aggregates showing a high degree of stability.

When considering the plant food supplying capacity of this soil the situation is obviously not so very favourable particularly with regard to potash and phosphates, though it should be noted that the soil samples for which analyses are presented were not taken from the soil which had been manured with sulphate of potash as previously described. The fact that "leaf scorch" does occur to some extent is a reflection of the position revealed by the analysis particularly when it is considered that this soil has an appreciable immobilising effect on potassium (see later in Table II). The difference in the nitrogen status of this soil as compared with that of K1. and K2. is well demonstrated in the condition of the foliage, no symptoms of nitrogen starvation being observed. In the pomological observations it was noted that a brown spotting is present on the foliage of some trees and the relationship of this to the low phosphate status of the soil is a matter worth further investigation as Wallace (5) describes a similar condition as symptomatic of phosphate starvation. As in addition to having a high calcium status this soil contains an appreciable quantity of calcium carbonate liming is unnecessary and might indeed be very deleterious. The extent to which liming was carried out in the past is well-reflected in the analysis, the 6″-12″ region containing considerably more lime than samples from lower down the profile.

Finally, it can safely be concluded from the data collected that this

should constitute a good fruit soil, though strict attention to certain aspects of manuring is essential to achieve best results.

ORCHARD K. 5. (PILTOWN DISTRICT).

This plantation which extends over an area of about five acres was planted with the varieties Bramley's Seedling, Lane's Prince Albert, Beauty of Bath, Newton Wonder, and Mere de Menage in 1913. Crab or Seedling stocks were used. No pruning has taken place for a number of years. Routine winter and scab spraying is practised. The trees which are of the bush and half standard forms were originally planted 12' x 12', alternate rows being subsequently removed however. Between-row cultivation was carried out for about 10 years after which a hay crop was taken for some years the orchard being finally let out in permanent pasture. From information available it is apparent that manuring has been carried out in a somewhat unsystematic fashion, part of the orchard receiving basic slag some years, another part sulphate of ammonia or nitrate of soda, and other parts sulphate of potash. No exact data is available as to the location of these applications. Farmyard manure has also been applied from time to time and grass mowings occasionally allowed to decompose on the ground above the root region. Best results are held to have been obtained from potash applications.

POMOLOGICAL OBSERVATIONS.

Tree Growth: In general growth and tree reaction is somewhat similar to that reported on when discussing Orchard K1. All varieties are stunted, young growth being very limited especially where Allington Pippin, Worcester Pearmain and Bramley's Seedling are concerned. The exception to this was Lord Derby (as in K1.) which has made good young growth and produces large highly coloured fruit. In a small orchard immediately adjoining, and which is situated in such a position that it receives a considerable quantity of runnings from manure heaps in the farmyard, tree growth is very vigorous, the trees being almost twice as large as those in this (K5) orchard.

Foliage: Leaves showed considerable reduction in size, thinness, and were of a distinct yellow-green hue. Premature leaf drop was very marked Bramley's Seedling and Allington Pippin being practically devoid of foliage at this time (late September). The foliage of Worcester Pearmain and Allington Pippin showed "leaf scorch" while irregular brown necrotic areas were obvious on that of Newton Wonder.

Cropping: The crop producing potentiality of the great majority of trees in this orchard was very low due to the inhibition of fruit bud development and the tendency for spurs die-off on the older wood. On most trees the only cropping wood was that between two and three years old.

Disease: Scab was general and very severe. Lane's Prince Albert showed many cankers while Worcester Pearmain and Lord Derby were less

severely affected in this respect. The last-mentioned variety and Newton Wonder showed considerable shoot die-back. Much of the canker was undoubtedly of a secondary nature.

Generally, it is obvious that Lord Derby and Mere de Menage have reacted considerably better than the other culinary varieties planted. Allington Pippin and Worcester Pearmain have behaved very unfavourably.

SOIL.

The drift which constitutes the parent material of the soil covering of this area is derived from a diversity of rocks among which Silurian and Sandstone particularly the former are most in evidence. It is noteworthy that these rocks outcrop in the higher altitudes of this locality and consequently, it appears logical to infer that this drift is of local origin. As might be expected, examination revealed the soil as being of a definite brown colour with practically no differentiation (except between surface and subsoil) into horizons. At a depth of about 15″ this soil becomes gravelly in texture eventually grading into almost complete gravel, as far as the major portion of the plantation is concerned. The extent to which stones and gravel are present is well illustrated by the following results:

Sampl	Stones and Gravel %	Fine Earth (—2mm) %
0″ — 6″	24.3	75.7
6″ — 12″	26.5	73.5
12″ — 18″	52.7	47.3
18″ — 30″	52.8	47.2

The general physical structure of this soil is of such a nature as to be conducive to excessive drainage. At time of sampling digging was performed with considerable difficulty, the soil although texturally light being somewhat compact. Such compactness, however, probably was much accentuated by the fact that severe drought had ensued. While the type of soil existing in the small orchard is essentially the same as the above, the surface soil is of a much darker colour and more friable.

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	Hyg. H_2O %	Loss in Solution %
6″—18″	15.6	18.4	32.2	31.3	1.4	0.7

Clay Fractions:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	SiO_2/R_2O_3	SiO_2/Al_2O_3	SiO_2/Fe_2O_3	Al_2O_3/Fe_2O_3
0″—6″	19.26	41.58	26.05	8.79	0.45	2.2	2.7	12.6	4.6
6″—12″	14.98	41.36	27.36	10.10	0.32	2.1	2.6	10.9	4.2
12″—18″	11.70	42.40	26.82	10.64	0.42	1.9	2.4	10.3	4.2
18″—30″	11.44	42.38	26.88	11.05	0.49	2.1	2.7	10.3	3.8

General Analysis:

Orchard	Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
K 5.	0″—6″	2.4	5.7	5.32	0	3.09	0.13	23.8
,,	6″—12″	1.7	5.9	—	0	—	0.04	—
,,	12″—18″	1.4	5.0	—	0	—	0.03	—
,,	18″—30″	1.3	6.0	—	0	—		—
Small	Surface Comp.	3.1	7.1	4.19	.4	2.43	0.16	15.2

Nutrient Status:

Orchard	Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
K 5.	0″—6″	H	M	VL(16)	<EL	M	L	Neg.	M
	6″—12″	MH	L	VL(16)	EL	L-M	MH	VL	M
,,	12″—18″	VL	L	VL(16)	<EL	L-M	M	Neg.	M
,,	18″—30″	VL	L	VL(16)	<EL	L-M	MH	Neg.	M
Small	Surface Comp.	H	M	VL(8)	L	H	M	Tr.	M

From the clay fraction analysis given above and from the profile observations recorded there is little doubt that this soil is of the typical Brown Earth type as defined by Gallagher and Walsh (2), the SiO_2/R_2O_3 approximating to 2 throughout the profile. This is just as might be expected considering the nature of its parent material.

The general and nutrient analysis agree with pomological observations depicting a position closely similar to that prevailing in Orchard K.1. Again the present unproductive state of the great majority of the trees is attributable to malnutrition with regard to potash and nitrogen. The potentialities of trees on this soil type at a higher level of nutrition than that pertaining is well illustrated by the excellent growth which has resulted in the small orchard. Data given in Table II showing that this soil has no appreciable immobilising effect on potassium points to considerable ease in introducing potash by surface application into the lower region of this profile where it can be easily accessible for plant use.

While a tendency to excess drying out exists there is little doubt that, with proper manurial treatment and the operation of a husbandry designed to conserve moisture in the past this orchard would be much more productive than it is at present.

ORCHARD K. 6. (PILTOWN DISTRICT).

Situated on a somewhat steep southerly slope this one acre orchard is about 36 years old. The trees are of the bush form and include the varieties Bramley's Seedling, Worcester Pearmain, Newton Wonder, Blenheim Orange, Beauty of Bath, Cox's Orange Pippin, Lady Sudeley, Grenadier and Allington Pippin. No information as to the stocks used was available. Subsequent to planting this orchard was cultivated for five years when dressings of dung were applied. Since 1910, it has been in grass having been meadowed frequently. Some six years previous to the time of our visit the owner decided to regenerate this orchard from a state of unproductivity, through the medium of better manuring and more efficient management. Since that time the ground around each tree has been top-dressed with farmyard manure in alternate years and a dressing of sulphate of potash to the extent of seven pounds per tree each year. During this period of regeneration also the grass has been cut and allowed to rot around the trees. Routine spur pruning has not been practised. In recent years winter and scab spraying have been systematically carried out.

POMOLOGICAL OBSERVATIONS.

Tree Growth: With Allington Pippin making 2½′ of growth, Cox's Orange Pippin 1½′ and Bramley's Seedling 1′, the vigour of these as of the majority of trees growing here may be considered satisfactory. However, considerable differences in tree vigour within the one variety prevailed Die-back of fruiting structures on older wood occurred to an appreciable extent. Bramley's Seedling appears to have responded much better to the treatment of the past six years than other varieties, the dessert trees in general appearing to have had less recuperative power.

Foliage: With the exception of Newton Wonder and Lord Derby which carried yellow-green foliage the leaves were large and of a healthy green colour. Tree of Newton Wonder showed considerable premature defoliation which was also evident in the case of Cox's Orange Pippin, the foliage and fruit of which however, manifested spray injury, Bordeaux Mixture being used as a spray.

Cropping: Worcester Pearmain was carrying a full crop of medium large fruit of a brilliant red hue Allington Pippin, a three-quarter full crop of medium to small fruit of high colour. Lane's Prince Albert and Bramley's Seedling a crop of similar quantity, the high coloured fruit of the former being medium to large, and that of the latter somewhat small. Lord Derby was carrying a relatively poor crop of fruit the colour of which was not accentuated. It is of interest to note that since improvement, the tendency

to fluctuating yields from season to season so prevalent in many orchards. is not evident here. While the cropping potential of the younger wood was good, fruit buds being abundant and plump. that of the older wood was poor consequent on the tendency for spurs to die-off.

Disease: Canker was very slight and scab slight. Die-back of younger shoots was severe on Lane's Prince Albert, Worcester Pearmain, and Lord Derby, being less severe on Allington Pippin and Bramley's Seedling.

SOIL.

As this orchard is on a somewhat steep slope variations in soil depth might logically be expected. This does occur the soil increasing considerably in depth on proceeding down the slope. Profile examination revealed a yellow brown soil, with the surface 9" a darker brown than the underlying material. Drainage was good. With increasing depth the light to medium loam texture of the upper 18" of soil becomes of a more gravelly nature, though this does not happen to the same extent as in K5. to which soil it appears closely related. Stones and gravel constitute some 40 per cent. of the soil at a depth of 2'. Of a mellow friable consistency (though tending to exhibit some compactness on drying out) this soil should allow of efficient root action though the range of this as far as depth is concerned. may be considerably limited in some places.

In view of the nutrient status determinations recorded below it is of importance to note that the profile samples for which data is given were taken from a pit excavated about midway between two rows of trees being consequently well removed from the region which had of recent years received manurial treatment. The surface composite sample was taken from the soil adjacent to trees and in the region of manurial application.

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution %
9"—18"	14.6	19.7	28.2	33.7	0	1.0	1.0

Clay Fractions:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
0"—9"	18.80	39.88	25.30	9.10	.96	2.2	2.6	11.6	4.3
9"—18"	14.74	40.78	28.14	9.87	.76	2.0	2.4	10.9	4.4
18"—30"	12.28	42.37	32.02	10.83	.52	2.2	2.7	10.3	3.8

General Analysis:

Sample Type	Sample	Hyg. H_2O	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
Profile	0″—9″	1.2	6.1	4.46	0	2.55	0.14	18.2
	9″—18″	1.2	5.8	—	0	—	—	
	18″—30″	1.0	5.9	—	0	—	—	
Surface	Composite	3.5	7.1	8.56	0	4.79	.19	25.2

Nutrient Status:

Sample Type	Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
Profile	0″—9″	MH	M	VL(8)	EL-EL	MH	M	VL	MH
	9″—18″	L	M	VL(12)	EL-VL	L-M	L-M	VL	M
	18″—30″	H	M	VL(8)	EL-VL	L-M	L-M	Neg.	M
Surface	Comp.	H	MH	M(48)	EH	H	M	Tr.+	M

As with K.5 this is another soil possessing characteristics typical of the Brown Earth type. Of a texture very similar to this soil also as shown by mechanical analysis the fact that it should essentially constitute a better soil lies in the fact that drainage though free is not generally excessive.

The general and "available" nutrient analysis point to the incidence of two spheres of fertility level here. (1) between the rows (profile sample) where no manuring had taken place and (2) near the trees. The information available indicates that prior to the era of improvement this orchard was in a poor state of productivity. This might indeed, be expected if the nutrient status was generally similar (as it probably was) to that of sphere (1). The effect of manuring is well reflected in the analysis.

Conforming with pomological observations that even though considerable improvement had been achieved, the nitrogen status as reflected in fruit colour and size (i.e. Bramley's Seedling and Allington Pippin carrying undersized fruit), is not yet satisfactory the total nitrogen analysis demonstrates a low content of this element. From some information as to potassium fixing and immobilising power (presented later in Table II) it is seen that considerable transference of this nutrient to the chemically unavailable form may take place in the subsoil during periods of severe drought.

Lying adjacent to this orchard but farther down the slope, another plantation embracing the varieties Worcester Pearmain, Lord Lambourne, Laxton's Superb, Ellison's Orange and Allington Pippin was started in 1937. Treatment of this orchard since planting has been along well ordered lines, cultivation involving the growing of manured crops being followed. All trees have made optimum growth and are in perfect health. The soil

in this new plantation is similar to that of the old, with the exception that it is uniformly somewhat deeper and had been limed heavily in bygone years (lime-spots in the subsoil).

ORCHARD K. 7. (PILTOWN DISTRICT).

Situated at a short distance from, but essentially similar as regards aspect, topography, and soil type as K.6 this two acre orchard after planting in 1904, was kept in cultivation for about 10 years and subsequent to this let out in permanent pasture. The varieties growing are Bramley's Seedling, Newton Wonder, Lane's Prince Albert, Worcester Pearmain, Allington Pippin, Cox's Orange Pippin and Gascoyne's Scarlet. From information available as to manuring it appears that this has taken place in a rather haphazard fashion, very little if any being carried out until recently. Some parts of this orchard were dunged during the five years previous to our visit. Sulphate of potash was also applied during this period, though not in any systematic way, no accurate information being available as to what trees received attention in this respect. In 1939, some 4 cwt. of sulphate of potash was applied.

POMOLOGICAL OBSERVATIONS.

Tree Growth: Young growth was very limited on the majority of trees. Cox's Orange Pippin was for all practical purposes a complete failure.

Foliage: Leaves were small and yellow-green in colour, those of Bramley's Seedling, Lane's Prince Albert, Newton Wonder and Allington Pippin showing "scorch." Premature defoliation was widespread.

Cropping: In addition to carrying a poor crop in this (1941) season, when that in the adjacent orchard was reasonably good, cropping potential was very low as indicated by much die-back of spurs on the older parts of branches and poor fruit bud development.

SOIL.

As noted previously, this soil is of the same fundamental type as that of orchard K 6. Due to lack of suitable information as to manurial treatment in the past, it was not considered a suitable subject for any detailed study. However, a surface composite sample taken from the soil adjacent to a number of trees when analysed was recorded as follows:

Hyg. H_2O %	pH	$CaCO_3$ %	Nitrogen %	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
4.0	7.3	0.1	.29	VL(12)	EH	VH	L-M	Neg.	M

Considering recent manurial treatment these analyses present a true picture of the position that might be expected to exist. The fact that the potash

status of the surface soil is high does not by any means preclude the possibility of deficiency of potassium as manifested in "leaf scorch" from occuring, as from data presented later, it would appear that the ease with which potash can penetrate into the subsoil is of definite importance. Previously one of us (6) has discussed the relationship between drought and the availability of potash and in this connection the fact that this is a relatively free draining soil apt to become very dry during periods of drought may be of significance. While the present nitrogen status of this soil is shown to be reasonably satisfactory, past treatment was such as to lead to considerable impoverishment in this respect, this being well reflected in tree characteristics.

An extension of this orchard planted in 1939 with Worcester Pearmain, Laxton's Superb, Ellison's Orange and Grenadier was progressing very unfavourably, growth being very poor with leaf-scorch rampant on foliage of a yellow-green hue. Though, the trees were deleteriously affected through barking by hares, this could not sufficiently account for the bad response evident. This was probably due to planting on a soil of low fertility status without any subsequent attempt to introduce plant food through appropriate cropping. While under cultivation cereal crops (unmanured) had been taken, the effect therefore, being to further deplete any reserves of nutrients which may have been initially present.

In this district but situated at a lower altitude than orchards K6. and K7., a soil with the following general features was examined and sampled. The local topography is gently undulating the site of sampling being a limestone quarry in which the carboniferous limestone showed horizontal bedding. The soil to a depth of about 6' was of a uniform brown to yellow brown colour throughout with the exception of the usual darkening of the surface soil. From the fact that the majority of the stones were obviously detritus from Silurian and Old Red Sandstone formations and because there was a clear-cut division between soil and rock (no debris from the latter intervening) it was quite obvious that this soil was of the transported category being derived from a parent material other than the underlying rock. Texturally, this soil appears to be somewhat heavier than that of orchards K.6. and K.7. Drainage is excellent being facilitated by a structure of the well-developed crumb type. Plant and tree roots appear to find this soil a suitable medium for development. Some preliminary analysis are recorded hereunder:

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution %
12"—24"	18.6	20.5	29.1	28.7	0	1.9	0.7

Clay Fraction:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
12″—24″	12.11	42.13	28.08	9.67	.70	2.1	2.6	11.7	4.6

These analysis and observations characterise the soil as belonging to the same Brown Earth group as the others referred to previously. Here, the underlying limestone would appear to have played but an insignificant part in soil formation, the typical brown limestone soil of Gallagher and Walsh (2) being fundamentally different from that described above. Soil of this type appears to be the dominant one in this district.

ORCHARD K. 8. (PILTOWN DISTRICT).

This plantation covering an area of two acres is topographically divisible into two parts (1) the south-east part constituting the major portion of the orchard is on somewhat flat to gently sloping ground; (2) the north-east part situated on sloping ground of higher elevation than part (1). It was planted in the year 1937 with the varieties Bramley's Seedling, Lord Derby, Grenadier, Worcester Pearmain, Laxton's Superb, Allington Pippin, and Gascoyne's Scarlet. Each tree has received a dressing of dung (derived from pig and poultry sources) annually, two cwts. of sulphate of potash having also been applied to the entire orchard since planting.

Tree Growth: The vigour of any one variety varies appreciably according to situation. On part (1) tree growth has generally been more vigorous than on part (2). Extension growth has been average for most varieties though considerably below the desirable optimum for all.

Foliage: In general the foliage was reasonably healthy if somewhat, of a light-green colour, though appreciable varietal variations in this respect were noticed. Trees of Worcester Pearmain and Bramley's Seedling which carried small yellow-green leaves exhibited a tendency towards premature defoliation. "Leaf Scorch" while severe on Grenadier foliage was considerably less so in the case of Bramley's Seedling, Gascoyne's Scarlet, Laxton's Superb and Allington Pippin and absent on that of Worcester Pearmain. The foliage of some trees of Bramley's Seedling, Lord Derby and Gascoyne's Scarlet was bronzed while a metallic grey-bronzing similar to that reported in connection with orchard K.4 was seen on some leaves of the first-named variety.

SOIL.

On preliminary examination it was seen that there is a distinct difference in the soil of Part (1) and Part (2). The soil of the former is much deeper and of a distinctly different colour than that of the latter and has the following characteristics being listed as Profile A in the tables of analytical data.

0"-10" Black-brown loamy soil with well-developed crumb structure, and with lime-spots present in the 8"-10" region.

10"-21" Dark-brown, friable, free draining soil with very small quantity of stones and gravel present.

21"-36" Light brown soil of sandy loam texture showing practically complete freedom from stones and gravel.

A striking feature of this profile (in comparison with the others reported on and that of part 2 of this orchard) is the comparative absence of stones and gravel throughout. The small quantity of such material present is sub-angular in form and of very mixed origin including pieces of carboniferous and silurian shales, sandstones, chert, quartz and limestone.

The soil typical of part (2) or elevated portion of this plantation is rather shallow with a considerable admixture of stones in the lower region of the profile before final gradation into limestone rock. An opportunity for accurate study of the profile relationships of this type was afforded by the presence of a quarry cutting on an adjoining piece of ground of similar topography. The surface soil to a depth of 1' is of a slightly blackish brown colour, the remainder of the profile to a depth of about 3½' being a soil of a rather grey-brown colour, which on drying out offers considerable resistance to crushing. While the underlying rock is limestone, an arenaceous form of this which decomposes very easily yielding a fine calcareous sand, outcrops close by. This soil is very free draining, and varies somewhat in depth from place to place. As noted previously, stones and gravel are present in fair amount being derived mainly from Carboniferous, Silurian and Old Red Sandstone formations. This soil is listed as Profile B in the analytical results.

Mechanical Analysis:

Soil	Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution %
Profile A	10"—21"	13.1	16.1	39.9	26.1	Tr.	0.8	0.7
Profile B	12"—30"	10.2	15.1	37.4	34.9	0.1	0.7	0.6

Clay Fractions:

Soil	Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
Profile A	0"—10"	21.16	37.26	21.60	8.02	0.53	2.3	2.9	12.4	4.2
	10"—21"	14.96	40.98	28.88	10.58	0.40	2.0	2.4	10.3	4.3
	21"—36"	12.58	41.23	24.44	12.69	0.45	2.1	2.8	8.7	3.1
Profile B	0"—12"	18.88	41.76	21.88	8.93	0.61	2.6	3.3	12.4	3.8
	12"—30"	11.20	45.16	24.59	10.57	0.62	2.5	3.1	11.4	3.7

General Analysis:

Soil	Sample	Hyg. H_2O	pH	$CaCO_3$ %	Nitrogen
Profile A	0″—10″	2.3	7.4		0.17
	10″—21″	0.8	7.5	Tr.	—
	21″—36″	0.6	7.3	0	0.04
Profile B	0″—12″	3.4	7 3	0.2	0 10
	12″—30″	0.8	7.5	0.1	0.03

Nutrient Status:

Soil	Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
Profile A	0″—10″	H	VL	EL	L	H	L-M	Neg.	M
	10″—21″	M	L	VL(8)	<EL	H	L-M	Neg.	M
	21″—36″	H	VL	VL(8)	<EL	MH	L	Neg.	M
Profile B	0″—12″	VH	M	VL(12)	L	VH	L-M	Tr.	M
	12″—30″	H	M	VL(12)	EL	VH	M	Neg.	M

The above analyses substantiate the observations recorded previously as to the occurrence of two distinct soil types in this orchard. The soil of part (1) is a Brown Earth derived from what appears to be a parent material of alluvial origin, the occurrence of the latter here being no doubt influenced by the close proximity of the river Suir. In other part (2) of this orchard the soil is apparently of the transition type previously discussed in the case of orchard K.4. While data presented later in Table I demonstrates that in each of these soils the greater part of the clay is in an easily dispersible form in view of the relatively low amount of clay present this does not result in unfavourable structure. Moreover, it is seen that in the presence of carbon dioxide a comparatively small amount of clay remains dispersed. This should contribute to good structural development, which in the instance of the soil of part (1) especially is of a rather favourable character. The latter soil also from the aspect of physical constitution should provide a good medium for tree growth the only danger lying in the possibility of excessive drainage. The shallowness of the soil in part 2 coupled with its light nature does not by any means recommend its use as a good fruit soil.

When recording pomological data it was noted that considerable "leaf scorch" occurs in this plantation particularly in part 2. The reason for this is fully evident from the nutrient and other analysis. While the nitrogen status is somewhat low, proper attention to nitrogenous manuring with a view to maintaining it, at least, at its present level should guard against malnutrition in this respect. From the data provided for available phosphate it is evident that the status of this soil in this respect is very low being somewhat similar in this respect to the soil of Orchard K.4 where

a like metallic-grey bronzing of foliage occurs. Here again, however, the magnesium status (as in K.4) is lower than is usually recorded while the calcium status is high. Some workers elsewhere have shown that it is under such conditions that magnesium deficiency is liable to develop.

ORCHARD K. 9. (PILTOWN DISTRICT).

Planted in 1938 on the site of an old orchard, this two-acre plantation is composed of the varieties, Bramley's Seedling, Allington Pippin, Worcester Pearmain, Beauty of Bath, Newton Wonder and Ellison's Orange. For two years after planting a crop of oats which received a complete manurial mixture was taken prior to laying down to grass. In 1938, and 1939, all trees received a dressing of liquid manure. Apart from the fact of planting on an old orchard site management up to the present has in the main been contrary to established principles.

POMOLOGICAL OBSERVATIONS.

Tree Growth: No variety had made satisfactory growth. Individual trees of all varieties showed severe marginal scorch. Many trees of Allington Pippin were almost completely devoid of foliage.

SOIL.

While the underlying rock consisting of limestone (arenaceous or otherwise) comes near the surface in some places hereabouts the soil of this orchard appears to be of considerable depth. The stones and gravel are of heterogenous origin consisting of carboniferous and silurian shales, sandstones, quartz, chert, flint and some others, all being rather rounded and somewhat like river gravel in this respect. The possibility of the occurrence of such a deposit is further strengthened by the fact that sand seams occur at some points underneath the soil in this plantation. The ground in this vicinity is generally of a rather "hummocky" topography, though the site of this orchard is level. With the exception of a very slight darkening effect due to organic matter in the surface 6", this soil is of a uniform brown to yellow-brown throughout and of a mellow loamy texture, friable and well, if not excessively, drained. When, boring with the augur easy penetration of the ground is obtained the subsoil being if anything less compact than the surface Below a depth of 2' there is a notable increase in the quantity of sand and gravel present.

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution %
6"—18"	15.2	18.1	34.1	31.2	0	1.8	0.7

Clay Fraction:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
6"—18"	15.75	41.75	28 69	8.81	0.50	2.1	2.4	12.4	5.0

General Analysis:

Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
0'—6"	3.0	5.9	6.6	0	3 83	0.25	15.3
6"—18"	1 8	5.8	—	0	—	0.09	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn	Fe(ic)
0"—6"	H	L	VL(8)	EL	L-M	M	Tr.	MH
6"—18"	H	M	VL(12)	<EL	L	MH	Tr.	M

These data demonstrate that the soil occurring here is in fundamental constitution very similar to that of rather general distribution in this district being of the Brown Earth type. While there is danger of drainage being excessive this should be a moderately good fruit soil judged from the point of view of texture and structure.

From the aspect of nutrient supplying capacity the position is however, far from satisfactory, the potash status being particularly low in which connection it should be noted that leaf scorch is severe. In the instance of this, as with many other of the soils reported on of the same physical make-up and type there is considerable danger of nutrient depletion through leaching, particularly with regard to nitrogen. This is one of the few soils being reported on tending towards deficiency with regard to calcium.

Data provided in Table I shows considerable stability of the structural aggregates constituting this soil—this is well reflected in the existing degree of friability.

ORCHARD K. 10. (PILTOWN DISTRICT).

This is an old orchard adjacent to K 9 and on the same soil type. Covering one acre, it has been in grass for some thirty years. The varieties planted include Bramley's Seedling, Newton Wonder, Lane's Prince Albert, Lord Derby, Allington Pippin, and Cox's Orange Pippin. Very little information was obtainable as to treatment and manuring beyond the fact that dung and sulphate of potash had been applied to some trees the location of which no information was forthcoming.

POMOLOGICAL OBSERVATIONS.

Tree Growth: Cox's Orange Pippin had for all practical purposes proved a complete failure. Severe die-back of young shoots on the upper branches was noted. It was generally apparent that dessert varieties were more adversely affected than culinary under the prevailing conditions.

Foliage: While the leaves of some varieties particularly Newton Wonder and Allington Pippin were small and of a yellow-green colour, these of others especially Lane's Prince Albert and Bramley's Seedling were large and of a normal green colour. It is by no means improbable that these last named varieties had received preferential manurial treatment, but in view of the paucity of information in this respect, these observations are of very limited value in comparing varietal reaction here.

SOIL.

The only noticeable difference between the soil of this and of the adjoining K 9. orchard is the greater extent to which blackness of the surface soil has developed here. Root growth appears to have been vigorous in this plantation.

General Analysis:

Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
Surface	3.0	7.2	6.53	.37	3.79	0.17	22.3
Subsoil	1.9	6.6	—	Tr.	—	.09	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
Surface	H	M	L(28)	MH	VH	MH	Neg.	M
Subsoil	H	L	VL(8)	EL	H	M	Neg.	MH

These analyses show the existence of a somewhat higher plane of fertility than that present in orchard K 9. Although the potash status of the surface soil is satisfactory, very little appears to have penetrated into the subsoil. In an adjoining field where a somewhat similar degree of alkalinity as that recorded for this soil prevailed boron deficiency symptoms in a sugar beet crop were noted. This may be of interest in view of the fact that the type of die-back reported as occurring in this orchard has been attributed by some workers to boron deficiency.

ORCHARD T1. (KNOCKLOFTY DISTRICT).

This one-acre orchard was planted in 1913 the varieties Bramley's Seedling, Lane's Prince Albert, Beauty of Bath, Allington Pippin,

Lady Sudeley, Worcester Pearmain and Cox's Orange Pippin being used. These trees are of the bush and half standard forms and are probably on crab stock. For five years subsequent to planting cultivation was proceeded with, crops of potatoes and roots which received dung and artificial fertilisers, being taken. Since then this orchard has been in grass, occasional dressings of dung being applied. During the past four years a mixture composed of 1 cwt. of sulphate of Ammonia and 3 cwts. of superphosphate has been applied annually. Beyond the potash added through dunging, other manuring in this respect received no attention. No regular pruning has been carried out During the four years preceeding our visit thinning out of overcrowding trees had taken place, and during this period also winter wash and scab sprays have been applied.

POMOLOGICAL OBSERVATIONS.

Tree Growth: While Bramley's Seedling with an average size of some 20′ in height and 25′ spread, has responded reasonably well, the dessert varieties planted have reacted very unsatisfactorily, Cox's Orange Pippin and Worcester Pearmain being worst in this respect, Allington Pippin less adversely affected and Beauty of Bath least so. Lane's Prince Albert was recorded as having an average height of 13′ with an 18′ spread. Young growth has been considerably restricted and weak except in the case of Bramley's Seedling on which variety numerous though short, growths were made. Dying back of young shoots was severe on Beauty of Bath, Worcester Pearmain, Cox's Orange Pippin and Lane's Prince Albert, and less severe on Allington Pippin.

Foliage: Although leaves were plentiful they were as far as most varieties were concerned subnormal in size and of a light green colour. Leaf-scorch was severe on sparsely clothed trees of Worcester Pearmain and on some trees of Bramley's Seedling. The foliage of Beauty of Bath and Lane's Prince Albert showed severe spray-injury.

Cropping: Fruit was small and of a poor colour where present.

Disease: Worcester Pearmain, Cox's Orange Pippin, Lane's Prince Albert and Beauty of Bath were badly cankered, and canker was of a secondary nature on Allington Pippin. Scab was rather severe on Cox's Orange Pippin, Allington Pippin and Lane's Prince Albert with a slight infection on Bramley's Seedling and Beauty of Bath.

SOIL.

Situated in gently rolling country this orchard is on slightly sloping ground with a southerly aspect. The underlying rock of carboniferous limestone while outcropping in some places is in the main covered by a relatively deep deposit of drift. From an examination carried out in a nearby gravel pit (overlain by some 2′-3′ of soil) it was seen that the

stones which were of a rounded form consisted mainly of limestone and carboniferous shales, flint, chert, sandstone, lime bearing sandstone, and quartz, while the fine material was rich in calcium carbonate. No very large stones were in evidence. The thin-covering of soil was of a uniform grey-brown colour though somewhat more brown than that of the typical grey-brown of our limestone soils (2). In the orchard also the profile exposed showed a soil of a uniform grey-brown colour throughout with a very slight darkening of the surface 6". While texturally, the soil appeared to be a medium to heavy loam there was quite a fair amount of stones and gravel present (25-30 per cent.) this quantity increasing considerably with increase in depth. During examination digging was carried out with some difficulty the soil being of a somewhat compact structure having become very desiccated during the preceding dry period. Drainage was undoubtedly good as demonstrated by the uniformly grey-brown colour throughout, though percolation should tend to be rather slow. Surface soil sample A (see analytical results) was drawn from the ground beneath Bramley's Seedling trees showing "leaf scorch" and surface Sample B from the soil under unscorched trees of the same variety.

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution %
3"—12"	17.6	19.8	37.3	20.1	0	2 8	1.2

Clay Fraction:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
3"—12"	14.44	48.34	21.33	9.04	0.77	3.03	3.8	14.2	3.7

General Analysis:

Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
Surface A	3.2	7.0	7.37	0.5	4.22	.31	13.6
Surface B	3.8	7.1	7.64	0.5	4.43	.14	31.6
3"—12"	2.8	6.7	—	—	—	—	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
Surface A	MH	L	MH(92)	VH	VH	MH	Tr.	M
Surface B	VH	M	M(51)	MH	VH	MH	Tr.	M
3"—12"	H	M	VL(8)	<EL	VH	M	Tr.	L
15"—24"	EL	M	EL(4)	<EL	M	L-M	Tr.	L

As can be seen from the foregoing data derived from clay fraction analysis this soil has a SiO_2/R_2O_3 ratio of 3 and this in conjunction with the observations recorded distinguish it as belonging to the brown limestone group of Gallagher and Walsh (2). With the exception of K1 and K.2 it is quite distinct from those previously discussed. From the analysis presented above and in Table I (giving data on structural stability) coupled with the recorded observations, it seems reasonable to conclude that this is a soil which should allow of good root development even though having a slight tendency to over-compactness, this latter being reflected in the analysis given in the above-mentioned table.

The nutrient and general analysis show (1) a satisfactory organic matter status (2) a variable nitrogen content with general status in this respect satisfactory (3) the fact that though the concentration of available potash in the surface soil is satisfactory a deficiency exists in this respect in the subsoil i.e., in the region of active absorption by plant roots (an outstanding feature of the subsoil of this orchard as shown in Table II, presented later, is its high potash immobilising power which becomes much more accentuated when submitted to the drying treatment indicated in the text), (4) a moderately high available phosphate status of the surface soil—this being a reflection of manurial treatment, (5) no lime requirement and (6) a satisfactory position with regard to other elements with the possible exception of iron which is recorded as being present in low concentration. In view of what has been written of the question of balance when discussing the incidence of "leaf scorch" in orchards K 1 and K 2 the fact is of interest that though the potash status of the surface soil from under trees of the Bramley variety showing this condition here is somewhat similar to that where no scorch occurs, there is a significant difference ir the nitrogen content of the samples examined. The results obtained in this connection conform with the experience of Wallace (5) though in addition the ability of potash to penetrate into and remain available in the high potash-immobilising subsoil of this orchard must be considered in advancing an explanation for the incidence of leaf scorch here. The drift, as has been noted. is somewhat calcareous and the importance of this in view of the predisposition to chlorosis of fruit trees growing on soils of alkaline and calcareous nature is worthy of note.

ORCHARD T. 2. (KNOCKLOFTY DISTRICT).

Situated adjacent to T. 1. this small (one acre) orchard was planted in 1913 with the varieties Bramley's Seedling. Lane's Prince Albert, Allington Pippin. Worcester Pearmain. Beauty of Bath. Gascoyne's Scarlet and Grenadier. No definite information was available as to the stocks used though they were probably of the crab type. The trees of half standard and bush form, were originally planted at distances of 21′ and 12′ but a considerable amount of thinning out has taken place. For the ten years previous to our visit this orchard had been in grass, providing grazing for calves. With the exception of fowl manure applied to a few trees of Beauty of Bath and a dressing of

superphosphate some years previously, no other attention has been devoted to manuring. No systematic pruning has taken place. Winter and scab sprays were applied from 1938 onwards.

POMOLOGICAL OBSERVATIONS.

Tree Growth: While growth in general was average the culinary varieties on the whole were making more progress in this respect than the dessert this being particularly obvious in the case of Bramley's Seedling. Young growth generally was weak and retarded being particularly so in the instance of Worcester Pearmain and Lane's Prince Albert, though considerably better where Beauty of Bath was concerned. Die-back of shoots was severe on Worcester Pearmain, Gascoyne's Scarlet, Grenadier and Allington Pippin, being less severe on Beauty of Bath and absent on Bramley's Seedling trees.

Foliage: Leaves were much reduced in size, of a yellow-green colour, and scarce on trees of some varieties, this being accentuated by a tendency towards premature defoliation. The leaves of some Grenadier trees were chlorotic. Leaf scorch affected all varieties chiefly Gascoyne's Scarlet, Grenadier and Lane's Prince Albert. The foliage of Worcester Pearmain showed some bronzing while that of a few Bramley Seedling trees exhibited a brown necrotic spotting.

Cropping: Fruit buds were smaller than normal and mainly confined to the young wood on the outer parts of trees. Cropping potential was low.

Disease: Lane's Prince Albert, Worcester Pearmain and Allington Pippin were cankered though not severely. All varieties showed a severe infection of scab.

SOIL.

The soil examined here was seen to be essentially the same as that discussed when dealing with Orchard T 1. The surface soil is however, of a darker colour, the subsoil in addition being of a somewhat more gravelly consistency. Lime spots occur in the subsoil confirming local information to the effect that heavy dressings of lime were applied at one time. This soil being of a rather compact nature offers considerable resistance to digging or boring, though it is however, sufficiently permeable to facilitate good drainage. According to the owner, strata of gravel run beneath the soil here, at some places coming relatively near the surface. This is to be expected considering the distribution of the drift in the district.

General Analysis:

Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
Surface Comp:	3.0	7.4	6.74	0.6	3.91	.27	14.5
Subsoil (1)	—	7.2	—	0.5	—	—	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
Surface Comp.	H	L	M(44)	L-M	VH	M	Tr.	M
Subsoil (1)	M	L	VL(8)	VL-EL	VH	M	Neg.	L

The general fertility level of this orchard with regard to nutrient supplying capacity is seen to be somewhat lower than that of T1., this corresponding with difference in treatment. The remarks made with regard to "leaf scorch" and possibility of chlorosis (which occurs to some extent) when discussing Orchard T1. apply equally well here. This appears to be a soil which either inherently or by induction is more suited to the production of culinary than dessert apples.

ORCHARD T. 3. (KNOCKLOFTY DISTRICT).

Planted in 1911, this plantation of 3½ acres consists of half standard and bush trees, of the Bramley's Seedling, Beauty of Bath, Worcester Pearmain, Cox's Orange Pippin, Lane's Prince Albert and Grenadier varieties. While planted at distances of 24′ x 12′ the number of trees has since been considerably reduced by rather general alternate thinning. Stocks of the crab or seedling types were used. Although occasional thinning out has been practised, no systematic scheme of pruning has been followed. Spraying has consisted of the application of a tar oil winter wash for some ten years with scab spraying for the three years preceding our visit. After planting, cultivation was continued for a period of ten years, root and cereal crops being taken the former receiving artificial fertilisers. This was followed by meadowing for two years, subsequent to which the herbage was removed by grazing. Manuring with dung had been practised for the fifteen years previous to 1941 while in 1940 one ton of sulphate of potash was applied, some previous applications of this fertiliser having also been made. No phosphates with the exception of these applied to root crops and in dung had been added.

POMOLOGICAL OBSERVATIONS.

Tree Growth: The most striking feature of this orchard was the vigour of culinary varieties particularly Bramley's Seedling though the weak-growing Lane's Prince Albert of this class did not appear to have progressed favourably. Trees of the former variety where allowed to develop ranged from 25′-30′ in height with a spread of over 30′, while those of the latter were generally of only some 10′-12′ in height with a spread of 12′-14′. Young growth was very limited and weak on all varieties except Bramley's Seedling. Severe die-back of young shoots occurred on Beauty of Bath, Worcester Pearmain, Cox's Orange Pippin and Lane's Prince Albert this being of a less severe orderwhere Grenadier was concerned, and absent from Bramley's Seedling.

Foliage: Leaves though generally somewhat subnormal in size and of a rather greenish yellow hue, were abundant. Beauty of Bath, Worcester Pearmain and Cox's Orange Pippin, showed a tendency for premature defoliation. Some "leaf scorch" was apparent on the folinge of the last two varieties and Grenadier, the leaves of the latter also showing some chlorosis and those of Cox's Orange Pippin an irregrlar brown necrotic spotting.

Cropping: From information available it would appear that Bramley's Seedling and some other culinary varieties crop well and reasonably consistently in this plantation. In addition to being small the colour of the fruit of the dessert varieties was generally somewhat poor. While the cropping potential of dessert varieties was low that of the majority of the culinary varieties was good this applying particularly to the younger wood.

Disease: In addition to being badly cankered the dessert varieties showed a severe attack of scab. The culinary varieties Bramley's Seedling and Grenadier on the other hand were canker free though showing slight scab infection. Lane's Prince Albert exhibited severe infection with canker.

General: The growth conditions operating in this orchard appear unsuited to the desired healthy development of the dessert varieties planted. On the other hand the environment created through management and treatment of this soil in the way indicated was conducive to excellent growth of the strong growing culinary varieties of the Bramley's Seedling class. In this connection it is of interest to note that the latter variety is also making very good growth though showing some leaf scorch in an adjoining plantation recently started.

SOIL.

Situated in the same district as Orchards T. 1. and T. 2. the soil in this orchard has developed over drift. The stones and gravel occurring throughout a 2½′ portion of the profile and comprising some 30 per cent. of the soil. are similar to those found in T 1. Below the surface 3″ which is of a dark-brown hue the soil of medium-clay loam texture is of a uniform light-grey-brown colour and appears from information advanced by the owner, to possess considerable depth. Digging was performed with relative difficulty due to compaction and induration of the soil, no doubt accentuated by the drought conditions operating for some time previously. Individual soil particles crumble fairly readily. The surface soil of the adjoining new plantation on wetting, becomes very sticky and adhesive.

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution %
11″—17″	17.3	29.6	31.2	19.1	0	1.5	0.7

Clay Fractions:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
0″—3″	20.82	45.91	14.45	5.89	0.45	4.3	5 3	20.8	3.9
3″—11″	14.02	51.67	19.18	8.33	0 63	3.6	4.6	16.5	3.6
11″—17″	9.67	48.94	25.22	10.12	0 94	2.6	3.2	12.9	4.1
17″—23″	9.11	48.16	25.82	9.55	0.57	2.6	3 2	13.7	4.2
23″—30″	9 07	46.64	27.52	9.82	0.56	2.4	2.9	12.6	4.4

General Analysis:

Sample	Hyg H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
0″—3″	3.5	7.2	4.22	0.6	2.45	0.18	13.6
3″—11″	1.5	6.8	—	0	—	0.14	—
11″—17″	1.6	6.5		0	—		—
17″—23″		6.5		0		0.06	—
23″—30″	1.9	6.1		0	—	0.03	
Suface Comp.		6.7		0	2.73	0.12	22.7

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
0″—3″	H	M	M(56)	EH	VH	L-M	Neg.	M
3″—11″	H	L	VL(8)	M	H	M	VL	M
11″—17″	L	L	L(24)	VL	H	M	VL	M
17″—23″	M	L-M	L(20)	VL	H	M	VL	M
23″—30″	H	L-M	VL(16)	VL-L	M	MH	L	M
Surface Comp.	M	MH	VL(14)	MH-H	VH	M	Neg.	L

The chemical composition of the clay fractions which shows a high SiO_2/R_2O_3 in the upper part of the profile though this decreases considerably with increasing depth, points to this soil as belonging to the Brown Limestone group of general distribution in certain districts in this country. It is apparent from the analysis that some leaching has occurred as evidenced by the translocation of iron and aluminium, suggesting a certain amount of soil degradation. From the aspect of mechanical composition this soil is shown to be of the medium loam class but when it is considered (as shown in some data presented later in Table I) that over 80 per cent. of the clay fraction in the subsoil is in an easily dispersible condition the fact that induration occurs, and that for practical purposes it has an effective textural reaction more approaching that of the clay loam class, can be well appreciated. Moreover, this effect expressed in adhesiveness and stickiness is reflected in the surface soil of the adjoining young plantation.

The nutrient supplying capacity of this soil is seen to be of a considerably higher order than is the case with the majority of orchards so far discussed. The position with regard to nitrogen cannot be considered altogether satisfactory, and though there is a moderate distribution of potassium throughout the profile (a high concentration in the surface soil) reflecting in this way manurial treatment there may as is shown in Table II be a tendency for immobilisation to take place when drying out ensues. The fact that a liming experiment carried out at one time in this orchard gave a negative result might have been logically expected considering the pH and calcium status as revealed by analysis.

This orchard provides a striking example of the operation of a set of conditions intimately associated with soil type which while conducive to excellent development of strong growing culinary varieties provides an unsatisfactory environment for dessert apple production.

ORCHARD T. 4. (ARDFINNAN DISTRICT).

Planted in 1938 (1 acre) and 1939 ($\frac{1}{2}$ acre) this orchard is composed of trees of the half standard form, some of the trees being on Malling XIII stock, and the remainder on crab. The varieties planted were Laxton's Superb, Beauty of Bath, Lord Lambourne, Allington Pippin and Bramley's Seedling, all trees being at distances of 24′ x 21′. So far only winter sprays have been applied. Cultivation has been practised from the beginning, manured crops of potatoes and sugar beet having been taken.

POMOLOGICAL OBSERVATIONS.

Tree Growth: While not by any means maximum, growth in general has been good.

Foliage: "Leaf Scorch" was very severe on the foliage of Bramley's Seedling, Beauty of Bath, Allington Pippin and Laxton's Superb on Malling Stock XIII, being less severe on Bramley's Seedling, Superb and Lord Lambourne on crab stock. The first two varieties were most affected in this respect, Allington Pippin and Laxton's Superb being less severely so and Lord Lambourne least. While scab was of slight distribution freedom from canker prevailed. Crab stock, it should be noted, is deeper rooting than Malling XIII. It is interesting to note that while the foliage from badly scorched Bramley's Seedling was shown by analysis to contain 0.26 per cent. of K_2O (dry weight basis) that of unscorched foliage had a content of 0.82 per cent. in this respect.

SOIL.

The soil of this plantation has been formed on drift of closely similar composition to that which constitutes the parent material of soils T. 1., T. 2., and T. 3., and from the point of view of fundamental type is identical with those. Texturally it appears to be of the medium to clay loam class with a relatively low content of stones and gravel (some 25 per

cent.) of a similar nature to those found in T. 1., distributed throughout. It is of a brown to grey-brown colour showing good drainage and allowing of greater ease of penetration than the other soils indicated above. This soil is subject to severe drying out the effects of this being very obvious at the time of our visit which coincided with a period of rather prolonged drought. From information available it appears that this soil is of considerable depth and uniformity throughout, water penetration tending to be somewhat slow. The local topography is flat. As very good differences in the incidence of leaf scorch on trees of the same variety (Bramley's Seedling) and stock (Malling XIII) growing in adjacent rows obtained, soil samples were taken with a view to examining the difference (if any) which existed in the soil beneath healthy trees (represented by Sample H) and affected trees (Sample D).

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Solution Solution %
4″—12″	14.9	24.9	40.3	15.8	0	2.3	0.8

Clay Fraction:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
4″—12″	14.92	52.08	16.89	8.93	0.61	3.6	4.9	14.4	3.0

General Analysis:

Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
Surface H	2.0	6.1	4.29	0	2.49	0.126	20.0
Surface D	4.1	6.4	4.31	0	2.50	0.125	20.0
4″—12″	2.3	6.4	—	0	—	—	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
Surface H	M	L-M	VL(16)	L	H	M	VL	MH
Surface D	M	L	VL(16)	EL-VL	H	M	VL	MH
4″—12″	L	EL	VL(12)	<EL	H	M	Tr.	MH

The clay fraction analyses presented above verify the observations recorded and identify this soil as being of the Brown Limestone type. From the point of view of texture as indicated by mechanical analysis, this soil

is identical with many good fruit soils. As can be seen from the analysis the potash status of the surface soil is decidedly low, deficiency being greatest where scorch occurs. Moreover, while the potassium immobilising power of the surface soil from beneath healthy trees seems to be negligible (Table II) that under scorched trees is definitely high. In addition, it is seen (from the same source) that the subsoil is very potent as a potassium immobilising material, its potency in this connection being much accentuated under the conditions of drying out incidental to the technique used. Some other points arising in this connection are given further attention later.

Attention to this orchard in future should prove of interest not only from the manurial aspect but, also from that of fundamental type, which appears to be of considerable importance in rendering this location more suitable for culinary apple production than for dessert, as many other factors such as texture as judged from mechanical analysis, drainage, etc., appear to be very similar to these associated with good dessert apple producing soils.

ORCHARD W. 1. (BALLYDUFF DISTRICT).

In planting this old (1890) orchard, trees of Bramley's Seedling, Grenadier, Lane's Prince Albert, Newton Wonder, Royal Jubilee, Cox's Orange Pippin, Worcester Pearmain, Allington Pippin, James Grieve and Blenheim Orange were selected. Crab or Seedling stocks were used and the trees are of the half standard and bush forms. While known to have been in cultivation at one time no information relative to this was available. It has been in grass for at least 15 years, no manuring beyond an occasional dressing of sulphate of potash from 1933 onwards having been resorted to during that period. This orchard with a somewhat northerly aspect is enclosed by a high wall Owing to indefiniteness with regard to management only general attention was devoted to recording conditions here.

POMOLOGICAL OBSERVATIONS.

Tree Growth: The trees show obvious signs of having developed in a favourable environment; growth, which is still very satisfactory on most varieties, having been good in the past.

Foliage: Leaf scorch was not evident in this orchard. The leaves of Allington Pippin, Cox's Orange Pippin and Worcester Pearmain were undersized and of a yellow-green colour, the incidence of this condition being closely associated with location within the orchard. Trees of Grenadier and Royal Jubilee in a few instances carried rather chlorotic foliage.

Cropping: Many trees carried a good crop; the extent to which fruit developed colour was a striking feature here. The colour of fruit from all varieties was much accentuated, those which are normally coloured, developing a brilliant red flush, while that of Bramley's Seedling and Grenadier in particular which is usually greenish yellow showed considerable "colour."

Disease: The general health of the trees is excellent, remarkable freedom from canker prevailing

SOIL.

This soil has been formed on drift which is of a somewhat mixed nature, though apparently considerably influenced by the locally outcropping old Red Sandstone rocks. Fragments of these together with some chert, silurian shale and quartz constitute the major portion of the sand and gravel of the adjoining (W 2) orchard soil with which that under discussion appears fundamentally identical The dark chocolate brown medium loam surface soil which is of friable consistency is underlain by material of a lighter brown colour and of similar texture. This soil is notably free from stones and gravel; only some 10 per cent. of this fraction being present. Drainage is good. The soil generally in the immediate locality extends to a considerable depth.

General Analysis:

Sample	Hyg. H_2O %	pH %	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
0″—12″	3.0	7.2	5.60	0.8	3.24	0.24	13.5
12″—24″	1.9	7 2	—	0.2	—	0 10	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
0″—12″	MH	L	MH(80)	L	VH	M	Tr.	M
12″—24″	M	VL	VL(16)	L	VH	M	Neg.	M

These analyses indicate the existence of a moderate state of fertility the available potash content though recorded as low, being sufficient to support normal growth of all crops with the exception of those having a high requirement in this respect, this soil being of a considerably higher order with regard to ability to supply this element than those recorded as "extra low" and "very low." Moreover, there is a reasonable distribution of potash throughout the entire soil. Indeed, from the aspect of nutrient supplying capacity this is a soil which should constitute a well balanced medium. Its general physical make-up is such as to favour good root development.

ORCHARD W. 2. (BALLYDUFF DISTRICT).

Planted adjacent to W 1. in 1936 and covering an area of about 8 acres this orchard is composed of the varieties Laxton's Superb, Ellison's Orange, Worcester Pearmain, Cox's Orange Pippin, American Mother, Blenheim Orange, Gascoyne's Scarlet and Newton

Wonder, all being on Malling XIII stock and planted at distances of 27′ x 21′. Winter pruning, and winter and scab spraying have been carried out according to usual methods. The trees were planted in grass, the tree rows having remained so up to the present, though the remainder up to within 4′ of the trees has been cultivated and cropped with roots and potatoes, which received ordinary manurial treatment. No manure, dung or otherwise has been applied to the tree rows since planting; at the time of examination the ground around the trees carried a thick mat of coarse herbage.

POMOLOGICAL OBSERVATIONS.

Tree Growth: Considering the method of planting and subsequent treatment adopted, growth in general has been satisfactory though below maximum; Allington Pippin,' Laxton's Superb, and Blenheim Orange, in particular making good progress.

Foliage: Some marginal scorch was evident on the foliage of Gascoyne's Scarlet, Newton Wonder and American Mother, while some trees of the latter variety also showed dead brown blotched areas of an interveinal location. In a few instances a grey-metallic bronzing similar to that recorded in some other orchards and varieties, was exhibited by leaves of the first named variety.

Disease: The trees were in the main healthy and disease free.

SOIL.

The surface soil is of a much lighter colour than that of the previous orchard. It has a rather umber colour throughout, the surface being slightly darker than the underlying subsoil. Of a rather friable consistency this soil allows of relatively easy penetration by a boring instrument. Drainage is good. The samples for which data are presented below were taken from a pit in ground somewhat similarly treated as that between the tree rows, the main purpose being to obtain information relative to soil type.

Mechanical Analysis:

Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution %
9″—27″	23.0	17.9	37.3	21.5	0	1.3	1.8

Clay Fractions:

Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
0—9″	16.59	44.38	22.13	9.47	0.86	2.7	3.4	12.5	3.7
9″—27″	10.76	44.21	26.38	9.99	0.68	2.3	2.8	11.8	4.1

General Analysis:

Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
0″—9″	2.3	5.6	3.33	0	1.93	0.23	8.4
9″—27″	1.5	5.3	—	0	—	0.07	—

Nutrient Status:

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
0″—9″	H	M	VL(12)	M	M	M	L	MH
9″—27″	H	MH	VL(16)	L-M	L-M	M	L	MH

The analyses presented above show this soil to be a medium loam of the Brown Earth type (though varying somewhat from the typical soil of this group). The good tilth of the soil is no doubt closely related to the fact that although clay is present to the extent of 23 per cent. of the fine earth only 1.4 per cent of this fraction is in a water dispersible form, this being further decreased in the presence of carbon dioxide. Physically, this soil should provide an excellent medium for tree growth and development. Moreover, the data provided in the nutrient and general analysis indicate a soil having good reserves of potash and nitrogen, the position with regard to the latter being particularly satisfactory in view of the low C/N ratio. The occurrence of leaf scorch may be due to a localised deficiency of potassium accentuated under the conditions of nitrogen supply obtaining.

ORCHARD W. 3. (BALLYDUFF DISTRICT).

This orchard consists of two parts. (1) a large plantation of 25 acres and (2) a small plantation of about one acre. Both were started in 1908 and as regards general cultural management, varieties, etc., have been treated identically. Bramley's Seedling, Lord Derby, Grenadier, Royal Jubilee and Royal Codling varieties were on crab or seedling stocks, all trees being of the bush form. This orchard has been in grass since planting being grazed by sheep for part of the year. No data was available as to manurial treatment beyond the facts that there was no record of dung ever been applied and that unknown quantities of sulphate of potash and sulphate of ammonia were used in 1939. It is of interest to note that part of plantation (2) is situated close to the farmyard from which it probably received effluent materials. Evidence existed of lime having been applied in this latter plantation also.

POMOLOGICAL OBSERVATIONS.

Tree Growth: While the great majority of trees were stunted there were some exceptions to this, most notable being the growth made by Royal Codling in plantation (2) when alternated in the row with Grenadier and

that exhibited by Bramley's Seedling in the part of this plantation situated near the farmyard. Young growth in general was very limited.

Foliage: On the whole leaves were scarce, reduced in size and of a yellow green colour, though in the case of the Bramley's Seedling and Royal Codling trees mentioned previously they were well developed and of a healthy green hue. Leaf scorch was severe on Grenadier, Royal Jubilee and Lord Derby while Bramley's Seedling and Royal Codling leaves were normal in this respect. Where the latter variety was alternated with Grenadier a fine example of varietal reaction in relation to this condition was evident, Grenadier leaves being badly scorched whereas Royal Codling leaves were healthy and unaffected. In addition to showing some purple-bronzing, Grenadier foliage in a few instances was chlorotic as was also that of Royal Jubilee and Lord Derby.

SOIL.

Formed on drift of a somewhat identical nature as that constituting the parent material of soils W. 1. and W. 2., the soil type of both plantations appears to be somewhat similar to these. The surface soil which extends to a depth of about 1′ is of a grey-umber colour with the surface 1″ somewhat darker than the remainder. The subsoil is of yellow to grey-brown colour and of a sandy texture. No signs of waterlogging were apparent, the soil being if anything somewhat droughty. While the surface soil of plantation (2) was of a darker brown than that of plantation (1), no other material differences beyond the fact that the subsoil in the upper end of the smaller was heavier and more retentive than elsewhere. The "stones and gravel" fraction which constituted some 20 per cent. of the soil was composed mainly of sandstone, quartz, flint, shale, and limestone (quite an appreciable amount). Soil samples D and H were taken in plantation (2) from beneath scorched and unscorched trees respectively.

General Analysis:

Sample	Plantation	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
Surface Comp.	1	2.3	5.5	3.81	Tr.	2.21	0.17	13.0
do.	1	2.8	5.7	—	0	—	0.10	—
do. H	2	2.6	7 0	4.05	0.12	2.35	0.23	10.2
do. D	2	2.1	6.3	4.74	0	2.75	0.19	14.5

Nutrient Status:

Sample	Plantation	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
Surface Comp.	1	M	L	VL(12)	<EL	H	L-M	Tr.	MH
do.	1	H	L	VL(12)	<EL	MH	L-M	Neg.	MH
do. H	2	H	L	VL(16)	EL	H	L-M	Neg.	L
do. D	2	VH	M	VL(12)	VL	H	L	Neg.	M

These analyses indicate the existence of a low state of fertility, this being in accordance with the attention afforded to manuring in the past. Obviously, tree growth reaction in this orchard is not so much an expression of inherent soil potentialities but rather of indifferent management.

ORCHARD W. 4. (BALLYDUFF DISTRICT).

This nine acre orchard which has a northerly aspect was planted in 1938 with Laxton's Superb, Worcester Pearmain, Blenheim Orange, Allington Pippin and American Mother. The trees of half standard form were planted at distances of 27' x 18', crab stock being probably used. While the trees were planted in grass the ground between the rows up to within 4' of the trees has been cultivated, crops of potatoes and roots being taken, a coarse mat of herbage consisting of weeds and grasses which have seeded being meanwhile allowed to form in the region around the trees. Dung was applied as a mulch around the trees in 1940 in which year a dressing of sulphate of ammonia was also applied. No other manuring has taken place beyond that added generally with the crops sown. Spraying has consisted of the application of a winter wash, while winter pruning has been systematically proceeded with.

POMOLOGICAL OBSERVATIONS.

Tree Growth: All trees have made reasonably good though by no means maximum, young growth.

Foliage: Leaves were abundant though somewhat undersized, those of American Mother and Gascoyne's Scarlet showing scorch, which was severe on some trees of the latter variety. The foliage of Laxton's Superb exhibited some brown spotting in addition to having a tendency to fall off prematurely, while that of Allington Pippin and Gascoyne's Scarlet showed a metallic-grey bronzing similar to that noted in Orchard K. 4. Some leaves of American Mother trees were affected by the presence of an interveinal brown blotching.

Cropping: Cropping potential was high, most varieties spurring very well.

Disease: General freedom from canker prevailed.

SOIL.

While one part of this orchard (upper) is planted on a soil derived from drift which appears to be mainly composed of sub-augula detritus from sandstone and carboniferous formations, the other (lower) portion is on a soil the parent material of which was obviously of alluvial origin. In connection with this it is worthy of note that the site is situated but a short distance from the river Blackwater, the lower portion being almost on a level with its banks. The stones and gravel which constitute but 10 per cent. of the soil of this (lower) part are of the same general origin though more rounded, as those present to the extent of 30 per cent. in the other part. Limestone occurs abundantly in this river valley being

flanked by Old Red Sandstone in the higher ground and this probably affords an explanation for the mixed nature of the stones present. It is of interest also in connection with the soil type found here that many of the southern sandstones being laid down in lime charged waters are calcareous, and may therefore, produce an effect somewhat similar to limestone in regard to some vital soil forming processes. The soil of the lower part is a light-medium loam of a dark umber brown colour and friable consistency to a depth of about 18" below which it becomes of a light brown colour and more sandy. Deeper in the profile, a layer of practically pure sand is present. The soil of the upper part is a medium loam of a somewhat grey-brown colour throughout (with slight "sandstone" tint), except for the usual darkening of the surface soil. It does not show the same abrupt change in texture as occurs in the lower end, though becoming considerably more gravelly with increasing depth. Both soils are free draining, that of the upper part being somewhat more compact than that of the other part, though both soils are relatively easily penetrated. The samples for analysis were taken in the tree rows.

Mechanical Analysis:

Soil	Sample	Clay %	Silt %	Fine Sand %	Coarse Sand Æ	$CaCO_3$ %	Hyg. H_2O %	Loss in Solution %
Lower Part	9"—18"	12.3	13.5	40.2	28.2	0	1.2	1.4
Upper Part	9"—24"	17.1	16.7	42.1	20.1	0	1.8	1.2

Clay Fractions:

Soil	Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	$\frac{SiO_2}{R_2O_3}$	$\frac{SiO_2}{Al_2O_3}$	$\frac{SiO_2}{Fe_2O_3}$	$\frac{Al_2O_3}{Fe_2O_3}$
Lower Part	0"—9"	21.99	40.98	19.92	7.38	0.53	2.9	3.5	14.5	4.1
" "	9"—18"	11.71	47.77	22.90	9.73	0.56	2.8	3.9	13.0	3.7
" "	18"—30"	14.54	39.11	24.06	13.90	0.51	1.9	2.7	7.5	2.7
Upper Part	0"—9"	15.88	47.44	21.18	7.99	0.54	3.1	3.8	15.8	4.2
" "	9"—24"	10.38	51.36	24.06	9.16	0.42	2.9	3.6	15.0	4.1

General Analysis:

Soil	Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
Lower Part	0"—9"	2.5	7.1	3.50	0.17	2.03	0.13	16.4
" "	9"—18"	1.8	7.2	—	—	—	0.09	—
" "	18"—30"	0.6	6.9	—	—	—	0.03	—
Upper Part	0"—9"	1.8	6.0	3.82	—	2.22	0.15	14.8
" "	9"—24"	1.3	6.2	—	—		0.05	—

Nutrient Status:

Soil	Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
Lower Part	0″—9″	VH	M	VL(12)	EL	VH	VL	Tr.	M
,, ,,	9″—18″	VH	MH	VL(8)	<EL	H	VL	Neg.	M
,, ,,	18″—30″	VH	MH	VL(16)	EL	L-M	VL	Neg.	M
Upper Part	0″—9″	M	L	VL(8)	EL	H	L	Neg.	MH
,, ,,	9″—24″	M	M	VL(12)	<EL	M	L	Neg.	M

From the analyses presented above, it is apparent that both these soils have clay fractions of a somewhat similar constitution to that typical of soil formed on limestone. In the instance of the soil of the lower part it is obvious that either leaching has proceeded to the extent reflected in the analysis viz. the SiO_2/R_2O_3 ratio of 18″-30″ regions being much lower than that of the overlying soil or that two separate depositions of alluvium have contributed to its formation.

Physically, both soils should be well suited to good growth and penetration of roots. It is of interest to note that there is an appreciable difference between the two types from the aspect of texture and structure that of the lower part not only containing a smaller quantity of clay fraction but also having a proportionally smaller amount of this in a dispersible form (see Table I) than that of the upper end. This is expressed in the greater compactness of the latter as compared with the former soil. The possibility of excess drying out occuring is by no means remote, but the facilities present for root penetration should help very materially to counteract the danger of any bad results likely to arise from this.

The general and nutrient analysis show a position which can by no means be regarded with complacency. a definite tendency towards deficiency existing with regard to nitrogen, potash. phosphate and magnesium and while the small amounts recorded may have been sufficient to support reasonable growth up to the present this cannot continue indefinitely. Although, present in low concentration, it is obvious however, that a good state of balance exists between the major nutrients present. The fact that leaf scorch occurs, particularly in certain susceptible varieties, is as might be expected from the analysis. The possible inducing action of the nitrogen applied through sulphate of ammonia is worthy of note in this connection. The relationship between the incidence of the grey-metallic bronzing on the foliage of Allington Pippin and Gascoyne's Scarlet and the low magnesium status of this soil should well repay further investigation. A point of interest in connection with this orchard is the fact that boron deficiency as expressed in crops of swedes and beet (i.e. "raan" and heart rot respectively) is of general distribution throughout the lower portion.

ORCHARD W. 5. (BALLYDUFF DISTRICT).

The eastern portion of this orchard was planted in 1934 with Bramley's Seedling, Newton Wonder, Laxton's Superb, Ellison Orange,

Worcester Pearmain and American Mother and the western four years later with Newton Wonder, Cox's Orange Pippin, Laxton's Superb, Charles Ross, James Grieve and Gascoyne's Scarlet, crab stocks being probably used. The entire orchard covers some 2½ acres and has been in cultivation up to the present, root and cereal crops being taken. The tree rows have been grassed down from stubble. No manures organic or otherwise have been applied.

POMOLOGICAL OBSERVATIONS.

While all varieties in the eastern portion appear to have promised well initially, having made vigorous growth, a decline in vigour is now apparent. In the younger, western portion all varieties are making good growth and spurring well with the exception of some trees in the southern end of the orchard which is subject to periodic flooding by reason of its proximity to the Blackwater. All varieties in the eastern section, especially Worcester Pearmain, and Laxton's Superb were cankered.

SOIL.

No very thorough examination was made of the soil in this orchard. In general the surface soil is of a gravelly character and is underlain by a sandy subsoil. One location in the southern end of the orchard (which as remarked previously is subject to flooding—this being evident in the gleying effect visible in the soil) where trees were making good growth, was characterised by the presence of a very sandy subsoil, while nearby where trees were failing no such sandy material was apparent on boring to a depth of 3′.

ORCHARD W. 6. (DUNGARVAN DISTRICT).

This one acre orchard was planted in 1937, with trees of the Bramley's Seedling, Allington Pippin, Beauty of Bath, Worcester Pearmain and Laxton's Superb varieties, planting distances being 27′ x 18′. Malling XIII stocks appear to have been used. The ground was broken prior to planting and kept cultivated since then up to within 3′ of the tree rows, which have been grassed down. Dung has been liberally applied to the tree rows for some years, this being the only manuring practised.

POMOLOGICAL OBSERVATIONS.

Tree Growth: Growth was good and fruitful though by no means maximum.

Foliage: The leaves of all varieties particularly Laxton's Superb were somewhat undersized.

Cropping: All varieties were spurring very freely indicating high cropping potential. Worcester Pearmain carried large brilliantly coloured fruit while that on Allington Pippin was of first quality being large highly coloured and completely free of blemish.

Disease: No trace of either canker or scab was obvious from a general inspection of the trees.

SOIL.

The soil type occurring here may be regarded as closely similar in essential constitution to that of Orchard W 7. which is discussed in some detail later. The surface soil of light to medium loam texture is of a brown colour to a depth of 18" below which it becomes more ochre brown. Structure is favourable to excellent drainage. Some data for a surface soil sample taken beneath an Allington Pippin tree carrying a magnificent crop is presented below.

Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
0"—12"	1.8	6.8	3.31	0	1.92	0.12	16.0

Nutrient Status;

Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
0"—12"	L	L	VL(12)	VL-L	H	M	Neg.	M

These analyses indicate a soil of low though balanced nutrient supplying capacity. If the position as reflected in these analysis is general for the orchard considerable attention to proper manuring will be essential to maintain progress.

ORCHARD W. 7. (DUNGARVAN DISTRICT).

This 9 acre orchard is made up of four sections the first of which was planted in 1937 and the others (one each) in the succeeding three years. These sections are listed as follows in the ensuing discussion: 1 (4 year old) 2 (3 year old) 3 (2 year old) and 4 (1 year old). Section 1 was planted with Allington Pippin. Laxton's Superb and American Mother; sections 2 and 3 with these and in addition Cox's Orange Pippin, Charles Ross. Blenheim Orange and Gascoyne's Scarlet, while section 1 consists of only two varieties viz· Worcester Pearmain and Laxton's Superb. The greater part of the orchard is under cultivation the system of cropping varying somewhat in the different sections. Manured crops of potatoes and roots have been taken in 1 and 2; section 3 has carried two successive crops of oats since planting while section 4 was cropped with wheat in the 1941 season. Manuring beyond that ordinarily applied in the cropping programme indicated, has not received attention.

POMOLOGICAL OBSERVATIONS.

Section 1.

Tree Growth: All three varieties here made excellent progress, Laxton's

Superb being up to 15′ high, Allington Pippin 12′ and American Mother, ordinarily slow to become established, up to 10′.

Foliage: Leaves were abundant, large and healthy on all trees except those under grass, where reduction in size and the development of a yellow green colour were obvious. The foliage of some trees of American Mother showed a slight irregular necrosis.

Cropping: As all varieties—even American Mother which is shy-spurring in the early years—were spurring freely, cropping potential was of a high order. The fruits on all three varieties were large well developed and highly coloured, those of Laxton's Superb being brilliant.

Disease: No signs of canker were evident.

Section 2.

As in Section 1. all varieties have made excellent growth even the exacting Cox's Orange Pippin doing remarkably well, making extensions up to 4′ in length and carrying some large highly colour fruit. The position as regards cropping potential and disease was similar to that in Section 1.

Section 3.

Tree Growth: While the growth of all varieties in this section is good it falls somewhat below the standard set by 1 and 2 in this respect. Some trees of Allington Pippin and Laxton's Superb were stunted.

Foliage: The leaves were smaller and of a rather lighter-green hue than those examined in 2. Leaf Scorch was manifested by some trees of Allington Pippin and Laxton's Superb.

Section 4.

The trees in this section are also making good growth. Occasional trees of both varieties showed leaf scorch which was more prominent in the case of Worcester Pearmain.

SOIL.

This orchard is situated in a flat piece of ground in a district of gently undulating topography. The soil has been formed on drift which from the nature of the stones occurring in the soil profile appears to have been predominantly influenced by detritus from the Old Red Sandstone formation. Stones and Gravel constitute some 30 per cent of the soil and being of a somewhat rounded and sub-angular form must have been subject to considerable abrasion by water. The surface 1′ of soil is of light-medium loam texture and of a deep chocolate-brown colour. Deeper down this colour lightens to an ochre brown which prevails to a depth of some 3′. Below this a transition to a material of sandy texture and somewhat grey colour was evident. While the surface soil is said to be somewhat plastic

when wet no compactness was evident, this soil being of a friable mellow consistency throughout. Drainage was free and the soil generally should constitute an excellent rooting medium.

The site of Profile A is located in Section 1 in the tree rows, while Profile B is from Section 4.

Mechanical Analysis:

Profile	Sample	Clay %	Silt %	Fine Sand %	Coarse Sand %	$CaCO_3$ %	Hyg. H_2O	Loss in Solution
A	24″—36″	12.8	28.1	33.3	26.5	0	1.0	0.8

Clay Fractions:

Profile	Sample	Ignition Loss %	SiO_2 %	Al_2O_3 %	Fe_2O_3 %	TiO_2 %	SiO_2/R_2O_3	SiO_2/Al_2O_3	SiO_2/Fe_2O_3	Al_2O/Fe_2O_3
A	0″—6″	22.16	38.03	22.17	6.84	0.64	2.4	2.9	14.8	5.1
	6″—12″	16.88	41.78	23 53	7.76	0.72	2.5	3.0	14.4	4.8
	12″—24″	14.98	42.35	26.89	8.94	0.84	2.2	2.7	12.6	4.7
	24″—36″	12.42	42.52	27.34	9.73	0.58	2.2	2.7	11.6	4.4

General Analysis:

Profile	Sample	Hyg. H_2O %	pH	Organic Matter %	$CaCO_3$ %	Organic Carbon %	Nitrogen %	C/N
A	0″—6″	2.9	6.1	6.88	0	3.99	0.38	10.5
	6″—12″	2.2	6.4	—	0	—	0.24	—
	12″—24″	1.9	6.5	—	0	—	0.08	—
	24″—36″	2.3	6.6	—	0	—	0.06	—
B	0″—8″	1.9	6.0	5.86	0	3.40	0.16	21.2
	8″—16″	—	6.0	—	0	—	—	—
	16″—24″	—	6.1	—	0	—	—	—

Nutrient Status:

Profile	Sample	Nitrate N	Ammonia N	P_2O_5	K_2O	Ca	Mg.	Mn.	Fe(ic)
A	0″—6″	H	M	L(24)	MH	VH	M	Neg.	M
	6″—12″	L	L	VL(12)	L	H	M	Tr.	M
	12″—24″	L	L	VL(12)	L	H	M	VL	M
	24″—36″	M	M	L(20)	M	MH	M	Tr.	MH
B	0″—8″	MH	MH	VL(12)	L	H	M	Tr.	MH
	8″—16″	L	M	VL(16)	L	H	L-M	Tr.	MH
	16″—24″	H	M	VL(12)	L	M	L-M	Neg.	MH

From the aspect of fundamental composition this is obviously a soil of the Brown Earth Group. While shown by the data presented to be a light loam, the fact that its reaction in the field is somewhat inconsistent with this can be explained by the fact that over 75 per cent. of the clay present, is in a water dispersible form. In a soil of this texture this cannot be regarded as an undesirable feature as in increasing compactness, it no doubt adds to the moisture and nutrient retaining capacity of what might otherwise be an easily leached soil.

As a source of essential nutrients it is a well balanced medium, a feature of fundamental importance in this connection being the moderate distribution of nutrient elements throughout the profile, which is notably non-existent in many of the other soils examined. From data presented in Table II it is seen that this soil while having a high retaining capacity for potash salts has no immobilising power either in the natural or dried state and from this it might be expected that any potash added in manure would exist in an easily available though water insoluble form for a considerable time. and move with relative ease through the profile i.e. it should be easy to introduce this element into the region of active absorption by roots. The reaction as regards acidity, and calcium status are ideal for the growth of most crops.

As a fruit soil this closely approaches the ideal having many of the most important characteristics implied by such.

GENERAL CORRELATION OF THE RESULTS.

While this survey can as yet be only regarded as having covered the reconaissance stage in the districts visited, and while it would no doubt, have been at this stage considerably more comprehensive in achievement had proper facilities as regards assistance both with the survey and subsequent analytical work been available the results obtained are of such fundamental interest to orcharding in this country that it seems desirable to attempt a general recording of their implications. In any such attempt the relationship between the health and growth of trees and the quality of fruit produced on the one hand, and management and soil characteristics on the other. is necessarily the matter of most concern.

Management: During the course of this survey it became obvious time after time, that some of the orchards visited were by no means suitable as a source of information of the type required. considerable vagueness existing as to past management especially with regard to manurial treatment. Within the one orchard in a number of cases, differences existed which could only have resulted from dissimilar treatments, yet in the majority of such instances information as to such was not forthcoming. From the information presented in the foregoing particular recording of each orchard it is apparent that the management of many of our orchards in the past has been anything but consistent with good practice. While,

the practice of grassing down when carried out efficiently, is no doubt conducive to the development of certain desirable features in relation to the health of trees and quality of fruit, we have recorded several instances where it has resolved itself into being the malpractice of greatest hindrance to successful fruit production. This is apparently due not only to inattention to manuring subsequent to placing in grass but to neglect to utilise properly the period of cultivation (if any). As examples of obvious instances of mismanagement we have such cases as (a) planting in grass; meadowing for a number of years followed by laying down to permanent pasture and subsequent removal of the herbage by stock, (b) planting in lea, cropping with cereals for some years and then meadowing before laying down to permanent pasture (c) planting in grass and cultivating to within 4′-5′ of the trees for some years, meanwhile neglecting the tree rows, before grassing down the entire orchard. Too often is it assumed that all old pasture soils have a reserve of fertility when the opposite is very often unfortunately the case. It does not appear to be sufficiently realised that the competition between young trees and grass for nutrients is very one-sided, the latter being the most favourably situated and best established, having prior choice. If it were there is little doubt that a better system of culture such as the maintainance of cultivation for at least five years coupled with the introduction of plant nutrients in reference to soil status in this respect followed by efficient grassing down and subsequent attention to manuring and proper disposal of the herbage, would be more universally followed.

Soil Characteristics:

Soil Group. At the outset, it was realised that the paucity of information which exists with regard to the nature of the soils in the districts visited was likely to impose severe restrictions on the progress of the studies in hand. We were fortunate however, in being able to associate all the soils examined with the major groups existing in this country as defined by Gallagher and Walsh (2). From field observations of profile characteristics it was possible to segregate the major portion of the soils examined into two well defined Groups (a) Brown Earth and (b) Brown Limestone, while a small number were obviously of a group transitory between these two. This field classification was later fully substantiated by clay fraction analysis. In relation to fruit growing potentialities, the important relationship has been established that while generally speaking soils of Group (a) are inherently suited to the production of high class dessert and culinary apples, those of Group (b) by no means constitute a suitable medium for the healthy growth and desired development of the former type. While dessert apples in Group (a) invariably carried well coloured fruit, in Group (b) the failure of this type to produce fruit of good colour except under conditions of gross nitrogen starvation was a notable feature. Although the reason for this differential reaction still remains a matter for future investigation it is thought that some character-

istics of these groups which will be discussed presently offer, in part at least, an explanation for this behaviour.

Physical Composition: Most authorities agree that the ideal orchard soil is a deep well drained medium loam of friable texture and from the mechanical composition results presented it would appear that at least, as far as texture is concerned, the great majority of soils examined should be ideal. However, as pointed out by Gallagher and Walsh (3) the usefulness of the mechanical analysis technique is limited in that it but gives an idea of ultimate particle distribution when actually a feature of major importance is the extent to which individual particles are aggregated into compound particles or structural units. In a number of instances the behaviour of soils in the field from the point of view of permeability, tilth and drainage did not always coincide with what might be expected from the mechanical analysis. This was particularly obvious where the two major groups were concerned. While no major differences as between the mechanical composition of these groups is obvious from the results it was generally observed in the field that the soils of the Brown Limestone Group were considerably more tenacious, more subject to induration on drying and less permeable than those of the Brown Earth Group, the transition group showing a more or less intermediate behaviour. Within any one Group differences were also obvious, it having been stressed previously that such soils as W 7. and K 8. while of a light loam composition behaved somewhat as medium loams might be expected to. Again, in the Brown Limestone Group the soil T 3. behaved more like a clay loam than the medium loam which it would appear to be from the data given. In investigating some problems of this sort in relation to Irish soils Gallagher and Walsh (3) adapted a technique of water dispersion, and found that in assessing such differences it was capable of presenting a much better picture when interpreted in conjunction with mechanical analysis data than was the latter alone. Some results from the examination of the soils under review according to this technique (including the carbon dioxide aspect) are presented in Table 1.

Orchard	Soil Sample	Percentage Clay (Mechanical Analysis)	Percentage of particles with settling Velocities equ. to clay (Dispersion Method)		Percentage of Total Clay in the dispersible form.
			Free from CO_2	CO_2 present	
K1 (a)	12″—23″	24.4	13.1	12.7	53.7
K1 (b)	7″—16″	15.0	7.4	1.9	49.3
K3	6″—16″	12.3	7.9	6.0	64.2
K4	12″—18″	17.8	5.8	5.7	32 6
K5	6″—18″	15.6	5.7	5.9	36.9
K6	9″—18″	14.6	6.1	6.1	41.1
K8 (A)	10″—21″	13.1	9.5	4.2	71.0
K8 (B)	12″—30″	10.2	9.1	3.6	88.2
K9	6″—18″	15.0	5.8	4.5	38.7
T1	3″—12″	17.6	9.3	8.4	52.3
T3	11″—17″	17.3	14.5	4.4	83.8
T4	4″—12″	14.9	4.2	4.0	28.2
W2	9″—27″	23.0	1.4	0.6	6.1
W4 (L)	9″—18″	12.3	6.1	5.2	49.6
W4 (U)	9″—24″	17.1	11.0	9.5	64.3
W7	24″—36″	12.8	9.5	7.0	74.2

The results presented above offer an explanation for the field behaviour of the soils in any one group in relation to tilth and permeability, in so far as that where mellowness and friability are features of soil structure as for example W 2, W 4 (L) and K (4) there is a relatively small amount of the total clay fraction present in a water dispersible form. The reason why such soils as T 3., W 7. and K 8. react very differently in the field from what might be expected from mechanical analysis is amply reflected in the existence in an easily dispersible form of the greater portion of this fraction.

In the instance of the last two soils viz: W 7 and K 8 (A) this characteristic appears if anything somewhat beneficial in adding compactness to soils which might otherwise, be too "light." With some exceptions the inclusion of carbon dioxide has made relatively little difference. This is just as might be expected considering the general absence of calcium carbonate from the samples studied.

From the point of view of structure it has been noted that there is an appreciable difference between the Brown Limestone and Brown Earth Groups. This difference which is not shown in the foregoing results is no doubt as noted previously (2) attributable to the more siliceous nature of the clay of the former group, it being argued, that other things being equal (viz. mechanical composition) a clay of high silica/sesquioxide ratio may be expected to be of a heavier texture than one of lower ratio. This effective textural difference between different soil groups is of general application to the soils of this country. The relationship of this to the differential nature of tree growth is well worth further study.

Finally, it may be stated that drainage and facilities for root penetration, with the exception of the comparatively few badly drained and shallow soils noted, were good. Where trees were planted in badly drained areas disastrous results followed and as drainage impedence leaves well defined, easily identified, symptoms on the soil profile the avoidance of areas subject to it should be a relatively easy matter.

Organic Matter: Although considerable variations in the organic matter status of the soils under study were found no clearcut relationship between this and tree-growth response was evident. In soils of some of the best orchards, e.g., K 4, W 7, and K 6 the organic matter status was considerably higher than in those of the others.

Nitrogen: One of the most striking features evident during this survey was the extent to which nitrogen starvation was rampant in the great majority of the orchards visited. In this connection there was a direct relationship between management and the incidence of symptoms of nitrogen starvation such as yellow-green colour and sparseness of foliage, premature defoliation, stunting, repression of spurring and consequent low yielding capacity, and high coloured sweet tasting fruit invariably much undersized. The greater the inattention to nitrogenous manuring the more pronounced the accentuation of these symptoms. As noted previously the system of culture in operation in most orchards is eminently suited to soil impoverishment with regard to nitrogen. The analysis presented run direcly parallel to the observation recorded. In this connection, it seems desirable to mention that the analytical results presented for "Nitrate Nitrogen" and "Ammonia Nitrogen" under the heading "Nutrient Status," are of no significance beyond demonstrating the inherent ability for these forms to develop in the soil and should not mislead the reader into thinking that they represent the nitrogen supplying capacity of the soil. The nitrogen content of many of the surface samples analysed is seen to be very low (between 0.10 and 0.20 per cent.) while in only one or two instances has the amount in the subsoils exceeded the latter figure. Relatively, medium to high contents 0.20 per cent. to 0.35 per cent. are in every case seen to be reflected in vigorous growth of trees and healthy colour of the foliage. While there is little doubt that high colour develops in fruit from nitrogen starved trees, it would appear from our results that excellent colour can be obtained under relatively high conditions of nitrogen nutrition, provided certain other conditions such as the existence of a sufficiently high plane of potash nutrition and suitability as to soil type prevail. Another example of the extent to which the preservation of a balanced nutrient medium is necessary for healthy growth has been afforded in relation to the occurrence of "Leaf Scorch." From the results presented especially in connection with Orchard T 1. it is seen that there is greatest tendency for leaf scorch to develop where the plane of nitrogen nutrition is high in comparison with that of potash.

C/N Ratios: From the data presented, it is seen that this value varies

very widely for the different soils examined, being highest where nitrogen starvation occurs. Some of the results in this respect appear high in relation to the data of other workers in this sphere. As some particular aspects of the significance of this ratio have been discussed previously when dealing with Orchard K 1. no further elaboration will be embarked on here.

Potash: The data presented indicate the widespread deficiency which exists with regard to potash in the majority of soils examined, and reveal the fact that a "low" to "medium" status as determined by the method used appears adequate for healthy growth and normal development of apple trees. From the aspect of the behaviour of potash fertilisers when applied to the surface soil the information provided in pointing to the restricted movement through the profile, accumulation taking place at the point of application (i.e. the surface soil) is of first rate importance. This is further well demonstrated in Table III where it is disclosed that although the soil at Glasnevin has received relatively heavy dressings of potash no appreciable penetration into the subsoil has proceeded, resulting in the apparent anomaly of "leaf scorch" occurring under conditions of high potash manuring. The most obvious expressions of potash deficiency in the orchards studied has been through the medium of "leaf scorch," which as can be seen from our observations, is of widespread distribution.

From our data it is obvious that "leaf scorch" is related to the potash status of the soil in a number of ways. It is apparent that the potash status of the subsoil is of more importance in deciding the incidence of this condition than that of the surface soil—in no case where leaf scorch has been reported was the available potash status of the subsoil satisfactory. This did not hold in the case of the surface soils. It is shown moreover, that many orchards must have been planted in potash deficient soils. Generally. also "leaf scorch" was noted to be most severe in the orchards planted on soils of the Brown Limestone Group. Further to the information already presented with regard to the above points, additional data are presented in Table II the results being obtained according to the method discussed under "Methods of Investigation." In a previous issue of this Journal (6) the relationship between the transference of available potash into an unavailable form in the soil when the latter is subject to drought has been discussed. In connection with the occurrence of leaf scorch this was thought to be of particular importance, as it concerns not only the ability of surface added potash to penetrate into the subsoil but also the ability of the available potash in the latter to remain in this form. Leaf scorch was noted to be particularly severe on soils such as T 4, where severe drying out was noticed. In presenting the results in Table II (which have accrued from experiments of a preliminary nature) the actual fixing and immobilising power is expressed in terms of cwts. of potassium sulphate per acre, each soil being treated, where each treatment was concerned, with a solution of this salt applied at the rate of 10 cwt. per acre. Column 1 shows the amount absorbed from an aqueous solution, Column 2, the

amount (of the 10 cwts. added) insoluble in sodium acetate-acetic acid solution, and Column 3, the amount insoluble after the drying treatment indicated. Data on the original K_2O status and clay fraction percentage and constitution is also included to facilitate subsequent discussion.

Orchard	Soil Sample	1 (cwts. per acre.)	2 Cwts. per acre.	3 Cwts. per acre.	K_2O	Clay %	$\frac{SiO_2}{R_2O_3}$
W7.	0"—6"	7	0	—	MH	—	2.4
	6"—12"	8	0	0	L	—	2.5
	12"—24"	8	0	0	L	—	2.2
	24"—36"	0	0	—	L	12.8	2.2
T1.	Surface A	7	0	—	VH	—	—
	Surface B	7	0	—	MH	—	—
	Subsoil (3"—12")	10	3	>10	<EL	17 6	3.0
	Subsoil (15"—24")	9	2	8	<EL	—	—
T3	0"—3"	0	0	—	EH	—	4.3
	3"—11"	6.5	0	—	M	—	3.6
	11"—17"	8	5	7	VL	17.3	2.6
	17"—23"	6	3	3	VL	—	2.6
	23"—30"	6	1	0	VL-L	—	2.4
T4	Surface (H)	9	Tr.	—	L	—	—
	Surface (D)	9	6	—	EL-VL	—	—
	Subsoil (4"—12")	9	2	>10	<EL	14.9	3.6
	Subsoil (12"—24")	10	3	>10	<EL	—	—
K1.	Surface (0"—6")	—	Tr.	—	<EL	—	—
	Subsoil (6"—18")	—	4	—	<EL	—	—
	Surface	—	3	—	<EL	—	—
	0"—6"	—	Tr.	—	<EL	—	2.8
	6"—12"	—	3	—	<EL	—	2.7
	12"—22"	—	4	0	<EL	24.4	2.3
	22"—30"	—	2	—	<EL	—	2.3
K2	8"—18"	—	0	0	<EL	12.3	2.1
K4.	0"—6"	9.5	0.5	—	EL		2.7
	6"—12"	9.5	2	8	<EL		2.4
	12"—18"	10	2	—	EL	17.8	2.5
	18"—30"	10	0.5	—	EL		2.1
K5	0"—6"	—	Tr.	—	<EL		2.2
	6"—12"	—	0.5	—	EL	15.6	2.1
	12"—18"	—	0	—	<EL		1.9
	18"—30"	—	0	—	<EL		2.1
K6.	0"—9"	7.5	Tr.	—	EL-VL	—	2.2
	9"—18"	7.5	Tr.	7	EL-VL	14.6	2.0
	18"—30"	7.5	0.5	—	EL-VL	—	2.2

While it is not intended to discuss at length the different aspects of the results presented above the following facts are evident, (a) while all the samples examined had a very appreciable fixing power for potash some variations in the power to fix this in a form insoluble in the extracting reagent used are apparent. Highest immobilising power in this latter connection is exhibited by the soils of highest SiO_2/R_2O_3 ratio or in other words by those of the Brown Limestone Group; leaf scorch is also most severe on these soils. (b) Drying out has a very appreciable effect on potash immobilisation as measured in the manner indicated—being greatest in two soils of the Brown Limestone Group. which are subject to drying out and in which trees are badly scorched. When previously dealing with individual soils other implications of the results have been dealt with, and need no further repetition here.

From our observations it can be gathered that there is considerable variation in the susceptibility of different varieties to leaf scorch the dessert varieties as a whole being most susceptible, though some of the culinary varieties show a considerable degree of susceptibility also. The fact that where leaf scorch occurs and may be difficult to remedy in certain soils, is due to the inability to introduce potash from surface applications (by which method such applications ordinarly take place, particularly in grass orchards) into the feeding zone of the roots, as a result of fixation and immobilisation, is of very evident importance in orcharding. Another instance of this is afforded (as has been remarked previously) in the young plantation at Glasnevin where as is shown in the following table the potash status of the surface soil is satisfactory, although some varieties are severely scorched. In connection with this condition in this orchard it is worthy of note that considerable additions of nitrogen to the soil have also taken place.

TABLE III.

VARIETY.	Scorch	Soil Sample	K_2O	K_2O Immobilised cwts. per acre. K_2SO_4
American Mother	Present	Surface	M	
		Subsoil	EL	5
King of Tomkins Co.	Absent	Surface	M	
		Subsoil	EL	5
do.	Present	Surface	VL	
		Subsoil	EL	7
Ellisons Orange	Present	Surface	MH	
		Subsoil	EL	8
Bramley's Seedling	Absent	Subsoil	EL	7

From the information provided it is obvious that in selecting an orchard site, especially when the object is to produce high quality dessert apples the extent to which potash in an available form is distributed

throughout the feeding zone is a matter of prime consideration. Moreover, the ease with which potash can be introduced, which as demonstrated is a characteristic of soil type, is of fundamental importance in this connection. Indeed the failure to realise that by the mere introduction of potasn into the surface soil tree demands for this nutrient cannot be satisfied until very considerable quantities have been added—varying with the soil, has no doubt largely contributed to the widespread occurrence of potash-deficiency symptoms in many of our orchards. There is little doubt that the excellence of growth and quality of fruit in such orchards as W 7. and W 1. is intimately associated with the potash status of the feeding region of these soils.

Phosphates: The fact that with few exceptions very little attention as far as the orchards visited were concerned, was devoted to phosphatic manuring is well reflected in the results from available phosphate determinations. In a number of instances "extra low" (0-81lb of P_2O_5 per acre) and "very low" (8-16) returns in this connection were obtained particularly where the general level of fertility as indicated by tree growth was of a low order. Where phosphates had been applied either through dung or phosphatic fertilisers it has resulted. as with potash, in such applications becoming localised in the surface soil, very little penetration into the subsoil taking place. Generally, it can be seen, that the phosphate status of the subsoil to a depth of 2½′-3′ is, except where phosphates had been applied, at least as satisfactory as that of the corresponding surface soil. While symptoms of phosphate deficiency as far as apples are concerned are rather difficult to segregate from those of nitrogen starvation, the relation between retarded shoot development, undersized foliage, premature defoliation, scarcity of and the incidence of a brown necrotic spotting on leaves, and low yields, to the low available phosphate status of the soils studied should be well worth future attention. Generally, it would seem from the results presented, considered in conjunction with the observations recorded, that lack of attention to phosphatic manuring has not resulted in such serious consequences as have arisen from potash and nitrogen starvation.

Other Elements: While the magnesium status of the soils examined was generally satisfactory one or two instances of "very low" supplying capacity in regard to this element have been noted. This characteristic appeared to be associatoed with a grey-metallic bronzing of the foliage of certain varieties. In no instance was a deficiency of calcium sufficient to inhibit normal growth and development noted, the majority of soils having a high content of this element in an available form. In the absence of information as to the manner in which manganese deficiency is reflected in the apple, it is impossible to draw any conclusions relative to the subject under investigation as to the significance of the negative test recorded for available manganese in a number of instances. The fact that any tendency towards chlorosis was not apparent except in one or two instances is in

accordance with what might be expected from a consideration of the pH and calcium carbonate returns.

Lime Requirement: Consideration of the results accruing from pH, available calcium and calcium carbonate determinations shows that in no instance is an application of lime likely to be of advantage. In fact the reaction of the majority of the soils examined is ideal for the growth of most crops. In some instances, where heavy dressings of lime had been applied in the past this is well reflected in the results. It appears desirable to point out that where orcharding is concerned the use of lime should be strictly controlled, application being only necessary in the case of very acid soils, excess lime being a predisposing factor to the development of chlorosis. Generally, from the work carried out it would appear that a deep, well drained, mellow, light to medium loam soil, of the Brown Earth Group well balanced with regard to the essential nutrient elements and of medium status in this respect should be the ideal aimed at for the production of high quality dessert fruit. Such a soil should preferably have a moderate reserve of available potash distributed throughout the profile.

SUMMARY.

The need for accurate knowledge as to the soil types in this country inherently suited to the production of apples of both the dessert and culinary types has been pointed out. Results accruing from a pomological and soil survey of a number of orchards in the counties of Kilkenny, Tipperary and Waterford are presented. The extent to which soil type, cultural management and manuring are reflected in tree response has been investigated and the correlations existing in this connection discussed. The possible significance of certain fundamental soil characteristics in explaining the observed difference in suitability for the growth of dessert apple trees, between soils of the Brown Earth and Brown Limestone groups has been intimated. Particular attention was devoted to the question of soil texture and structure as factors in tree development. It has been demonstrated that the extent to which the clay fraction is water dispersible has a significant influence in determining the potentialities of a soil as a rooting medium.

The analytical and pomological data point to widespread deficiency with regard to nitrogen and potash, and indicate that inattention to proper manuring and management has been responsible for a low state of productivity in many orchards. In paying particular attention to the question of "leaf scorch" interesting information has evolved as to the incidence of this physiological disorder in relation to potash deficiency as affected by soil type, drought, and movement and immobilisation of this nutrient subsequent to application in potassic manures. Research in this sphere is being continued. Data as to the phosphate, magnesium, calcium, manganese and iron status of the soils examined are presented, and the need for further investigation of the significance of some of these nutrients

in relation to tree health indicated. The fact that none of the soils studied is in need of lime is pointed out.

From the results so far obtained it has been possible to define certain characteristics desirable in a soil required for the production of high class dessert apples.

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SUGAR BEET GROWING

Broadcast talk given by MR. JAMES J. GLAVIN, B.Sc., N.D.A., Chief Agricultural Adviser, Comhlucht Siúicre Eireann Teoranta, on Saturday, 27th February, 1943.

As you have just heard it is my privilege to speak to you to-night on Sugar Beet—a crop which ranks in the present emergency next in importance to wheat and potatoes, for it provides not only an essential article of our daily diet, SUGAR which could otherwise be obtained only from overseas, but also valuable by-products for animal consumption. It is only in an emergency of the present magnitude that the wisdom of ensuring home supplies of any commodity is fully appreciated and particularly so when that commodity is vital to the life of the Nation.

Sugar beet is, as I said in a previous talk from this Station, often underestimated by the man in the Street, and for that reason I think my then remarks can bear repetition in this talk:

One statute acre of sugar beet provides on the average:

30 cwts. of White Sugar—sufficient to supply 129 people with the present weekly ration for a period of 12 months.

18½ cwts. of Molassed Beet Pulp—the equivalent in feeding value of 18½ cwts. of Oats or 15½ cwts. of Maize.

9 tons of Tops and Crowns—the equivalent in feeding value of the produce of half a statute acre of Swedes or Mangels, and valuable after by-products such as Molasses, Factory Lime, etc., all of which are of economic importance in the present time. Besides these valuable products the inclusion of sugar beet in the crop rotation ensures the preservation of soil fertility and increased yields in succeeding corn crops. My farmer listeners will appreciate that modern farming depends for its success on a proper system of crop rotation designed to conserve and improve the fertility of the land and increase its productivity. Where cultivation is limited to the production of a few isolated crops, failure is bound to follow with subsequent deterioration in value and yield of succeeding crops. A root crop is an essential part of a proper rotational system, but unfortunately the cultivation of such crops is not always profitable. The advent of sugar beet, however, turned the arable farmers' loss into a profit, for unlike root crops—turnips and mangels, which it can replace in the rotation—it can with ordinary care and attention be grown with a considerable margin of profit and, at the same time, owing

to its extensive root system, leave the soil in better condition. Apart altogether from its value as a rotational cleaning crop it has the supreme merit of being a cash crop with a guaranteed market and price and on which substantial cash advances are made during the growing period. Even seed and manures are obtainable from the Sugar Company on credit terms. Like all other countries where sugar beet is the mainstay of arable farming, Ireland has recognised its value, not only as a valuable rotational crop but as a source of an essential household commodity for the people—Sugar.

Sugar beet growers should therefore realise, particularly those who are cultivating the crop for the first time this year, that they are engaged not only in the production of a profitable rotational cash crop but also one of vital importance to the Irish people. They should therefore resolve that they will give the crop such care and attention as will result in the production of the maximum output of sugar per acre with the minimum of production costs. I appeal for the active support and co-operation of all 1943 beet growers in this respect and I feel confident that that support will be as readily forthcoming in this vital year as it has been in the past.

You will be pleased to learn that through the unceasing efforts of the Directors and the General Manager of the Sugar Company and the whole-hearted support and co-operation of the responsible Government Departments, sufficient manufacturing materials will be available at each of the four Sugar Factories during the coming season to ensure the manufacture into sugar of the produce of the total contract acreage of sugar beet which will be allotted within the next few weeks. You will also be glad to hear that over 70,000 acres have been applied for, sufficient acreage to meet the full requirements of the four factories, each working to full capacity. This is as was to be expected, for apart altogether from the increase in the basic price from 70/- to 80/- per ton of beet, the Government made arrangements whereby each sugar beet grower could purchase, in addition to his normal quota of fertilizers, a Compound Fertilizer specially prepared for sugar beet to the extent of 4 cwts. for each statute acre allotted and grown under contract and at a substantially reduced price provided for by Government Subsidy. The terms of the new Contract also provide that each grower can purchase Molassed Beet Pulp at a comparatively cheap price viz. £5 5 0d per ton and can, subject to the due performance by him of his obligations under the Contract, obtain a permit to purchase sugar up to a maximum of four stones in any one case.

The time at my disposal does not permit me to go into all the details of cultivation, manuring, etc., essential for the production of high yields and sugar contents but I would advise you to read and follow closely the instructions contained in the literature supplied to you by the Company. I would however remind you that the Company provides at each Factory a staff of highly qualified experienced Agricultural Advisers whose services are available, free of charge, to beet growers. I would strongly recommend you, and especially those growing for the first time this year, to avail of

these services and thus ensure maximum output of sugar per acre.

There are however a few important points in beet production which deserve special attention this year and which I now wish to emphasise.

As you know, the supply of artificial manures, while better than last season, is strictly limited and consequently it behoves all farmers whether beet growers or otherwise, to make the best possible use of available supplies and to use them only in the production of essential crops. Farmyard manure and seaweed are of considerable value—each possessing all the growth and development and, in addition, the capacity for improving the essential ingredients, Nitrogen, Phosphates and Potash, required for plant physical condition of the soil, as well as its fertility. Farmyard manure, I am sorry to say, is far too often allowed to go to waste in the farmyard due to improper care and management. Farmers should see to it that it is properly stored and heaped; that there is no loss in drainage or loss of nitrogen by over-heating. These losses can be easily avoided by making the manure heap on dry level ground, as compact as possible, and placing a layer of earth or turf mould around the base to absorb any of the liquid which might escape. Again, animal urine is also often allowed to go to waste. It should be either collected by drainage into special containers or absorbed by peat for subsequent application to the land. When I tell you that one ton of well rotted farmyard manure contains on an average the equivalent of $\frac{3}{4}$ cwts. Nitrate of Soda; $\frac{1}{2}$ cwt. Superphosphate (35 per cent.) and 1 cwt. of Kainit, and that one ton of pure cow urine contains the equivalent of 1 cwt. Nitrate of Soda and $1\frac{1}{2}$ cwt. Kaihit you will appreciate the importance and value of these products and the necessity for preserving and storing them in such manner that the losses are negligible. Seaweed, as already stated, is also very valuable for it, like farmyard manure, is a complete fertilizer being particularly rich in Potash and Salt, both of which are most suitable for sugar beet. Farmers in the seaboard areas should make the best possible use of all available supplies of this product and should not allow it to go to waste on the seashore. Such wastage is a National loss in present times. Both farmyard manure and seaweed are very valuable manures for the beet crop and should be applied as liberally as available supplies will permit. Regarding artificial manures, a special manure known as "the 1943 Compound Fertilizer for Sugar Beet" can be purchased by each contract sugar beet grower to the extent of 4 cwts. for each statute acre of sugar beet grown under Contract. This Compound Fertilizer is being prepared and reserved specially for beet production and must not be applied to other crops. In fact its application to the potato crop might be injurious. To obtain this fertilizer beet growers should hand immediately the duly completed Contract Certificate and Order Form which they receive from the factory to their normal manure supplier so that he can forward it, when completed by the grower, to the manufacturer in good time to enable supplies to be effected.

I may here remind beet growers that while the supply of fertilizers available this year is better than last year, it is less than that applied in former years. More liberal dressings of farmyard manure or seaweed with such fertilizer dressings as are available, together with more careful attention to details of cultivation such as preparation of the seed bed, careful sowing with the full rate of seed supplied, early and careful singling, frequent horse and hand hoeings and weeding will go a long way towards making up for the fertilizer deficiency. Growers who wish to purchase artificial manures under the Company's Credit Scheme can do so to the extent of £3 per contract statute acre. Full particulars regarding this Scheme can be obtained from the Factory or local manure merchant.

You will be glad to know that through special steps taken by the Directors of the Company in past seasons sufficient stocks of home produced sugar beet seed of a high quality are available to meet the full requirements of each grower. Seed at the rate of 20 lb. per statute acre will be supplied to each contractor, and I would remind, and even go so far as to warn growers that it is in their own best interests that the full quantity of seed supplied by the Company should be sown on the contract acreages. The seed should be sown carefully at a depth of 1″ and rolled afterwards. Past experience has shown that many crop failures have been traced to careless seeding, either too shallow or too deep. Careful sowing on a well prepared seed bed will ensure an even braird of healthy vigorous growing plants—the fundamental essential for subsequent root growth and development. As to the time of sowing I would recommend any time after the first week in April up to mid May. The best yields however are obtainable when the crop is sown early in April, and particularly if soil and weather conditions are then favourable. It is much better however to delay sowing than to sow when soil and weather conditions are unfavourable.

The horse and hand hoe should not be spared as soon as weeds appear but care should be taken to ensure that the young seedlings are not injured by either hoeing too closely or covering the seedlings with soil. Singling or thinning should start as soon as the plants have developed four leaves. This operation is very important and if done in a careless or haphazard manner will reduce the ultimate crop yield very considerably. It should be done with the greatest possible care and at the correct time. Delayed or careless singling may affect the ultimate crop yield by as much as 5 tons per statute acre of washed beet. The plants, preferably the strong and healthy ones, should be spaced from 6″ to 9″ apart according to the width of the drills. The aim should be to produce a uniform crop of not less than 35,000 strong healthy plants to the statute acre. Where the dressing of farmyard manures, seaweed or artificials is high the plants may be left closer together than formerly recommended.

Beet growers should not spare the horse or hand hoe. Weeds use up manures, absorb moisture and check the growth of the young plants,

hence they should be eradicated by frequent after-cultivation, including weeding. Besides the destruction of weeds, hoeings aerate the soil, promote conditions conducive to rapid leaf growth and root development and should therefore be repeated frequently. May I remind you of the old but wise saying "Sugar is hoed into the Beet."

Unlike other crops, harvesting is spread over a period of about three months commonly known as the Campaign and extending normally from mid October to mid January. Harvesting, which consists of removing the roots from the soil, crowning and carting into heaps for subsequent delivery to the factory, should be carried out during periods when soil and weather conditions are favourable. It is not practicable and neither is it profitable for the grower to harvest and deliver all his beet at the one time. Deliveries must be spread out in accordance with factory instructions so as to give all growers equal opportunities for delivering the produce of their crops. Harvesting should not be delayed until late in the season for it then becomes not only laborious but very expensive and entails undue hardship for the workers as well as serious losses for both factory and grower. Such hardships and losses can easily be avoided by harvesting well in advance of the receipt of factory delivery orders.

I have already said that the by-products of the crop—tops and crowns and molassed beet pulp—are of considerable value. Beet growers who do not or will not utilize these products to the fullest possible extent are depriving themselves of the extra benefits which beet growing affords. Tops and crowns, and molassed beet pulp are of excellent feeding value for all classes of farm stock and should form part of the daily ration. I would refer in particular to pulp which can be purchased this year by growers at a price of £5 5s. 0d., per ton—a price considerably below its present market value. I would strongly advise each of the 1943 sugar beet growers to make sure that he procures the maximum quantity of this valuable and cheap product guaranteed to him under his contract.

To summarise, I will give you a few tips which, if followed carefully, will go a long way towards producing more profitable returns for you and more sugar for the Nation:

1. Grow after a corn or potato crop.
2. Avail of every opportunity from now on to cultivate and prepare the land for your beet crop.
3. Make the best possible use of available manures—farmyard, seaweed and artificial.
4. Sow evenly the full quota of seed supplied to you on the contract acreage and roll afterwards.
5. Single early and carefully and you will ensure a full braird of strong healthy plants.
6. Eradicate weeds.
7. Hoe sugar into the beet by frequent horse and hand hoeings.

8. Harvest the crop when favourable weather conditions obtain.
9. Feed your tops and crowns.
10. Secure the full quota of pulp guaranteed to you under your contract.
11. Co-operate with the Company regarding your deliveries—it will help you and your fellow growers.

And now to conclude, I appeal to everyone connected with the Irish Sugar Industry—factory staffs, beet growers, farm workers and transport companies—to co-operate to the fullest possible extent during the coming season and thus ensure, come what may, that so far as sugar is concerned there shall be no want in the country in 1944.

NOTES ON APPLE SCAB IN 1942.

BY

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Spraying experiments for the control of apple scab were begun at the Albert Agricultural College, Glasnevin, in 1935 and continued until 1941. For reports on these experiments see this Journal Vol. XXXV, No. 1, 1938, Vol. XXXVI, No. 1, 1939 and Vol. XXXIX, No. 1, 1942. At the end of 1941 the main spraying experiments ceased; and the varieties Allington Pippin, Annie Elizabeth, Bramley's Seedling and King Edward VII were thereafter included in the ordinary spraying as applied to the remainder of the orchard. At the same time observations were continued in 1942, especially on those trees which had previously been unsprayed for several years. The results of one year's spraying for prevention of scab on these old control trees are recorded in these notes, along with an account of the disease and its control on Bismarck, the latter variety alone being retained by the writer for demonstration purposes. The present article may therefore, be considered in the nature of a final report on the experiments begun in 1935.

The variety Newton Wonder, which is sulphur sensitive and was sprayed post-blossom with Bordeaux mixture, is not included in this paper, and as the principal treatment for scab in the orchard in 1942 was by spraying with lime-sulphur, only the results from the latter are here reported. Arising out of the experience gained during the past seven years, one pre-blossom spray was given to all trees in 1942, being applied at the pink-bud stage at a strength of 1 in 40, but three post-blossom applications were given, each at a strength of 1 in 80, the third being in lieu of the omitted green-bud spray.

Spraying in 1942 was carried out on the following dates:

VARIETY	Pink-bud Stage	Petal-fall Stage	Second post-blossom application.	Third post-blossom application
Bismarck	28th April	27th May	22nd June	16th July
Other Varieties	1st May	29th May	22nd June	18th July

The control of scab on the crop of trees which had been previously unsprayed for several years is shown in Table 1, and the results from the nearest tree of the same variety sprayed in 1940 and 1941 included for comparison.

TABLE I.

COMPARATIVE RESULTS FROM ADJACENT TREES SHOWING CONTROL OF APPLE SCAB BY FOUR APPLICATIONS OF LIME-SULPHUR IN 1942.

VARIETY	Spraying for apple scab previous to 1942.	Total Yield			Per cent.		
					Scab Free	Apple Scab	
		cwt.	qr.	lb.		Slight*	Severe*
Allington Pippin	None 1935-1941	3	0	6	65.2	22.5	12.3
Allington Pippin	Sprayed 1940-1941	3	2	5	89.4	9.3	1.3
Annie Elizabeth	None 1937-1941	5	0	24	31.5	27.2	41.3
Annie Elizabeth	Sprayed 1940-1941	5	1	17	77.2	16.9	5.9
Bramley's Seedling	None 1938-1941	5	1	5	44.8	27.5	27.7
Bramley's Seedling	Sprayed 1940-1941	4	2	15	66.8	22.0	11.2
Bramley's Seedling	None 1939-1941	3	2	18	41.9	33.7	24.4
Bramley's Seedling	Sprayed 1940-1941	7	0	5	40.9	27.0	32.1
Gascoyne's Scarlet	None 1937-1941	2	1	4	61.3	26.2	12.5
Gascoyne's Scarlet	Sprayed 1940-1941	4	1	3	88.1	7.7	4.2
King Edward VII	None 1937-1941	1	2	6	54.9	32.6	12.5
King Edward VII	Sprayed 1940-1941	1	1	3	76.2	19.6	4.2

* Slight scab one to four spots of infection. Severe scab more than four spots.

APPLE SCAB AND ITS DEVELOPMENT IN 1942.

Climatic conditions throughout flowering were very favourable for fertilization and the resulting crop was heavy. Apple scab was present from May onwards, but as June was dry (see Table III), the disease made little or no headway during the latter month on any of the sprayed trees. Heavy showers were frequent early in July and some development of scab then occurred, but its spread was checked by the third post-blossom application of spray. The weather from the beginning of July was dull, cloudy and wet, and these conditions continued for the remainder of the growing season. Lack of sunshine and showery weather were propitious for a renewed outbreak of scab towards the middle of August, and the disease was still further favoured by an extremely wet September, see Table III. Hence, even on sprayed trees, a considerable amount of late spotting of the fruit occurred.

In the case of unsprayed trees of Bismarck (b) and (d), microscopical examination of their buds in December, 1941, had shown 20 per cent. of them to have bud-scales infected with *Venturia inaequalis*. Therefore, it was not surprising that counts made on the 24th June, 1942, showed 60 per cent. of the fruit on these trees to be already spotted with scab,

though up to then the climatic conditions had not been favourable for the development of the disease. On the occurrence of wet weather in July the fungus fructified freely on affected fruit of these control Bismarcks. and the disease spread rapidly on their foliage until practically every leaf was attacked. The results of four applications of lime-sulphur on control of scab on Bismarck are shown in Table II, and the rainfall during the growing season in Table III.

TABLE II.

CONTROL OF APPLE SCAB ON BISMARCK BY FOUR APPLICATIONS OF LIME-SULPHUR IN 1942.

Bismarck Trees	Spray treatment in 1942	Total Yield cwt.	qr.	lb.	Per cent. Scab Free	Apple Scab Slight	Apple Scab Severe
(a)	1 pre- & 3 post-blossom sprays	3	0	8	53.2	29.4	17.4
(b)	None	2	3	11	1.9	3.8	94.3
(c)	1 pre- & 3 post-blossom sprays	2	2	15	85.1	12.9	2.0
(d) (half tree)	None	1	1	6	5.5	16.4	78.1
(d1) (half tree)	1 pre- & 3 post-blossom sprays	0	2	23	88.6	6.3	5.1

TABLE III.

Number of days on which precipitation occurred at Glasnevin, and rainfall for each month during the growing season 1942.

MONTH	NO. OF DAYS.	RAINFALL IN INCHES
APRIL	13	1.12
MAY	18	4.20
JUNE	4	0.12
JULY	19	2.14
AUGUST	22	3.76
SEPTEMBER ...	18	4.48
TOTALS ...	94	15.82

DISCUSSION.

The growing season of 1942, extending from April to September inclusive, was the wettest at Glasnevin for eleven years. It was very favourable for apple scab, and was one in which a third post-blossom application of spray proved its value. The control of the disease was quite good on the majority of trees throughout the orchard, and the trees recorded in Tables I and II represent those with the worst scab in their respective varieties.

It is seen from an examination of Table I, that on the six old control trees sprayed for the first time, clean fruit varied from 31 to 65 per cent. and the quantities of marketable fruit (as represented by columns Scab Free and Slight Scab) range from 58 to 87 per cent. Considering the climatic conditions in 1942 and the state of scab on these trees previously, the control of the disease on them by four applications of spray may be regarded as fairly satisfactory.

The most obvious fact from an examination of Table I, however, is the difference in percentages of scab free fruit between trees which had been regularly treated for scab and those sprayed for the first time for several years. In five of the six pair of trees, this difference is over 21 per cent. in favour of those regularly sprayed. Not only is there a difference in the percentage of clean fruit in each of these five cases, but there is also a difference in amounts of severe scab, this being from 8 to 35 per cent. worse on the old control trees. These facts clearly indicate that many more centres of infection were present on the old control trees than on those regularly sprayed. In one case only, the fourth pair (Table I) was more disease present on a tree which had been regularly sprayed than on the adjacent old control. The latter developed over 58 per cent. of scabbed fruit and its behaviour in this respect agreed with the other old controls, but on the neighbouring tree here the disease was somewhat worse. Whether the density of the foliage and the exceptionally heavy crop carried on this regularly sprayed tree were the main factors involved in this result is not known.

Bismarck is recognized as one of the most susceptible varieties to apple scab. Notwithstanding this fact and the wet season, the control of the disease on Bismarck was good, Table II; 53.2, 85.1 and 88.6 per cent. clean fruit occurring on sprayed trees, compared with 1.9 and 5.5 per cent. on unsprayed specimens; and 82.6, 98.0 and 94.9 per cent. respectively of marketable fruit against 5.7 and 21.9 per cent. on unsprayed trees. It is interesting to compare the results from these sprayed Bismarcks with those from the old controls Table I, which received exactly the same spray treatment in 1942. Such a comparison shows that better control of the disease occurred on Bismarck in spite of the variety's susceptibility to scab. This again demonstrates the importance of regular spraying for

effective scab control, as 1942 was the third year for these Bismarcks to be systematically sprayed. The old control trees in Table I represent a case where a green-bud spray should have been applied for better prevention of scab. Had such a spray been included, then, obviously no comparison of the results with neighbouring trees would have been possible, and it was for this reason that the green-bud application was omitted from these particular trees.

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SOIL FERTILITY AND CROP ROTATION

Broadcast talk given by MR. J. J. BRADY, M.Agr. Sc., Inspector Department of Agriculture, on Monday. 4th January, 1943.

Soil fertility is the basis of successful farming and it is unnecessary to stress its importance. Every farmer is conscious of the value of a rich soil and his chief concern is, how he can best maintain and, if possible, increase the fertility of his land. In recent years this has become a more difficult task. The necessity for increased food production has imposed a drain on the plant food reserves of the soil. The import of animal feeding stuffs has practically ceased. This simply means that our soils are deprived of the manurial constituents which would accrue from their consumption by livestock. During the past few years supplies of artificial manures were far short of the country's requirements. While every effort is being made to provide the maximum quantity of fertilisers for next season's crops, the total quantity is not likely to be greater than that which was available last year.

From what I have said it will be apparent to all that we must rely almost entirely on natural rather than artificial manures to supply the plant foods required by crops next season. Indeed, the shortage of artificial fertilisers would be of little consequence if on every farm an adequate supply of farmyard manure could be produced. Farmyard manure is the best example of a complete manure. In addition to supplying all the important plant nutrients, the organic matter which forms its bulk has a very beneficial effect on the physical properties of the soil and promotes those conditions which favour the growth of vigorous healthy crops.

It is recognised that farmyard manure has no equal in the conservation of soil fertility. The immediate concern of every farmer should be its production in maximum quantity and the prevention during storage, of the loss of its most valuable constituents. You may ask how can the production of dung be increased? An obvious way consists in utilising for the purpose the considerable proportion of our cattle population which is normally fed outdoor during the winter months. This may be achieved by confining store cattle to a shed or enclosed space in a sheltered situation during the night where they may be foddered and provided with sufficient litter, the resulting manure being allowed to accumulate on the site. A farmer who adopts this plan will have no difficulty in disposing of his surplus straw. He cannot put the straw to better use and he will be agreeably surprised by the greatly increased quantity of dung which will be available for his crops in spring. The quantity of dung may also be increased by the more liberal use of litter in byres, stables and all the other farm out-offices. Not alone will the more generous use of bedding increase the supply of

dung but it will reduce loss of nitrogen which is the most valuable constituent of the manure.

Even when stored under the best conditions, dung loses some of its manurial value, but under bad conditions the loss may be very great. Nitrogen is lost as a result of fermentation, and both nitrogen and potash, in soluble form, are lost when the liquid which oozes from the heap is allowed to drain away. These losses can be avoided almost entirely by keeping the manure heap built up in a tidy and compact fashion and by placing some absorbent material, such as turf mould, around the heap to soak up the escaping liquid. When the absorbent material becomes saturated it should be thrown up on the heap and a fresh supply put in its place.

The escape of liquid from the manure heap is not the only source of loss. By far the greater quantity is, in many cases, lost by direct drainage from byres, stables and piggeries. Liquid manure contains in soluble form most of the potash and nitrogen excreted by animals. No effort should be spared to conserve this valuable material. Every gallon saved and applied to the land, either directly or indirectly, will mean an increase in the productive capacity of the soil. Indeed, the conservation of all the liquid manure which is normally lost in this country would go a long way towards obviating the need for artificial manures like sulphate of ammonia and muriate of potash.

The most convenient method of conserving liquid manure is to have it absorbed in sufficient litter or other suitable material and added to the manure heap. Surplus straw could not be used to better advantage. Bog mould is also a very useful absorbent for liquid manure. At one time it was used for this purpose on many farms and a revival of this excellent practice would contribute greatly towards the maintenance of soil fertility. Liquid manure may also be collected in tanks. Under the Farm Improvement Scheme administered by the Department of Agriculture it is now possible to obtain grants towards the erection of liquid manure tanks and also for the provision of a concrete floor and surrounding walls for the farmyard manure heap. It is hoped that farmers will avail themselves of these facilities and so provide better means of conserving the manure on their farms.

Farmers in seaboard areas can supplement their supplies of farmyard manure by collecting seaweed. Like dung, seaweed is a complete manure and, although, it is relatively deficient in phosphate, it contains about the same amount of nitrogen and about twice as much potash as dung. Seaweed can be used for any crop on the farm to which farmyard manure is normally applied. It is particularly valuable for potatoes, beet and mangels. Farmers in coastal districts should lose no opportunity to collect as much seaweed as possible before next spring.

The making of compost provides another means of increasing the fertility of the soil. Waste vegetable matter such as weeds, chaff, leaves, etc., can be converted into valuable humus by composting. Various methods of making compost are practised but the basic principle is the same in all, namely the ensuring of conditions in the compost heap which will induce the decay or rotting of vegetable matter. I do not propose to give the details of compost making now. Full information is available in a special leaflet on the subject obtainable from the Department of Agriculture.

At this stage it is desirable to refer to lime. Lime performs so many functions in the soil that it may be regarded as one of the most important factors in soil fertility. The various effects of lime cannot be dealt with in this talk, suffice it to say that no soil which is very deficient in lime can produce satisfactory crops and the application of an adequate dressing to land which is badly in need of it has a very marked effect on its cropping capacity. The growth of clovers, which results in the addition of combined nitrogen to the soil, and the activity of free living bacteria which fix atmospheric nitrogen and thus make it available to crops, are factors of great importance in the maintenance of soil fertility. The value of clovers cannot be over emphasised. In addition to providing nutritious herbage these valuable plants are capable of adding the equivalent of a dressing of sulphate of ammonia to the land free of cost. Every farmer should see that clover, particularly wild white clover, grows freely in his pastures. Neither clover nor the useful forms of bacteria will flourish in soils which are badly in need of lime. From this aspect alone, the importance of lime is obvious and no soil in need of it should be allowed to remain without an adequate dressing. If you have any doubt regarding the lime requirements of your land you should consult your local Agricultural Instructor.

I may remind you that the Lime Subsidy Scheme which is operated in each county by the Committee of Agriculture enables farmers to obtain lime at reduced rates.

So far I have dealt with the principal materials at our disposal for maintaining fertility. The proper utilisation of the land is, however, of great importance. Good cultivation is essential before fertility can be used to the best advantage in crop production. In fact, a potentially fertile soil may be rendered much less productive by indifferent or bad cultivation. Farmers accustomed to the growing of tillage crops are well aware of these facts but in the grazing districts the importance of good cultivation does not appear to be always fully realised.

Crop rotation is also of prime importance in relation to fertility. It is well known that crops differ in their manurial requirements and if one particular crop is repeated on the same land for a number of years it may so deplete the soil in one of the plant nutrients that the cropping capacity of the land is impaired. In this country, however, there is little doubt

that disease and the growth of weeds would become the first limiting factors to the continuous production of a cereal crop on the same ground year after year. To control weeds and crop diseases are the chief reasons why farmers adopt a system of crop rotation. Owing to the increased acreage under tillage the supply of dung on many farms, particularly in the grazing districts has been entirely inadequate to permit of the inclusion of a manured crop in the usual position in the rotation. Mainly as a result of this, the growing of two or three successive grain crops has been common in recent years. This system of cropping is conducive to the development of cereal diseases and to the growth of weeds and sooner or later would seriously impair the productive capacity of the land. It is not good practice to take more than two successive grain crops. Farmers who have no facilities for growing a cleaning crop would be well advised to sow a mixture of Italian ryegrass and red clover with the second grain crop. In the following season a crop of hay will be obtained. The resulting aftergrass will, if not grazed, provide a great bulk of very valuable material for ploughing under in the autumn. This system of ploughing-in the aftergrass from a temporary ley is an excellent way of increasing fertility and improving the physical condition of the soil for future cropping.

Where three or more successive cereal crops have been grown, the land may be too foul to grow another cereal crop. In such cases probably the best course would be to fallow and clean the land during spring and early summer and lay it down to pasture without a nurse crop. The young ley may be grazed from the start in preference to meadowing and the employment of sheep for the purpose will accelerate the restoration of fertility. As an alternative, the temporary ley system might be adopted with a view to improving fertility before laying it down to permanent pasture. The most suitable treatment would vary with circumstances and farmers who are confronted with problems of this nature should obtain the advice of their Agricultural Instructor. Incidentally, first crop grass will be regarded as compliance with any Compulsory Tillage Regulations in force in 1944 to the extent of not more than one-fourth of the quota.

In the farmer's own interest and in the interest of the nation the maintenance of soil fertility is of supreme importance. It is the farmer's most valuable asset, an asset which should not be recklessly dissipated but must be kept intact and growing by frequent and generous contributions.

Before concluding I may mention that Special Leaflet No. 21—The Maintenance of Soil Fertility—may be had free of charge from the Department of Agriculture, Dublin.

TABLE SHOWING IN A GENERAL WAY THE NATURE OF THE YIELDS OBTAINED IN EACH COUNTY.

County	Gooseberries	Strawberries	Raspberries	Blackcurrants	Apples	Pears	Plums & Damsons	Other Fruits
Carlow	Very Good	Good	Very Good	Very Good	Very Good	Good	Very Good	———
Cavan	Very Good	Average	Above Average	Average	Good	Good	Good	Very Good
Clare	Average to Very Good	Good	Very Good	Average	Very Good	Very Good	Very Good	Good
Cork	Very Good	Above Average	Very Good	Very Good	Very Good	Very Good	Very Good	Good
Donegal	Average	Average	Very Good	Average	Above Average	Good	Very Good	Average
Dublin ...	Very Good	Very Good	Average	Below Average	Good	Very Good	Very Good	———
Galway ..	Very Good	Good	Good	Above Average	Very Good	Very Good	Very Good	Very Good
Kerry ...	Very Good	Good	Average	Good	Very Good	Very Good	Very Good	Very Good
Kildare .	Good	Good	Good	Good	Above Average	Very Good	Very Good	Good
Kilkenny	Above Average	Good	Average	Above Average	Very Good	Very Good	Very Good	Good
Laoighis	Good	Good	Average	Good	Good	Very Good	Very Good	Good
Leitrim ...	Above Average	Below Average	Good	Average	Good	Good	Poor	———
Limerick	Very Good	Very Good	Good	Very Good	Very Good	Very Good	Very Good	Good
Longford	Very Good	Above Average	Good	Above Average	Very Good	Average	Very Good	Good
Louth ...	Very Good	Good	Good	Average	Good	Very Good	Very Good	Poor
Mayo	Very Good	Above Average	Below Average	Average	Good	Good	Average	Good
Meath ..	Good	Good	Good	Above Average	Very Good	Very Good	Very Good	Very Good
Monaghan	Very Good	Good	Good	Good	Good	Good	Very Good	Very Good
Offaly ..	Very Good	Very Good	Average	Good	Very Good	Above Average	Very Good	———
Roscommon	Very Good	Very Good	Good	Good	Very Good	Good	Good	———
Sligo ..	Above Average	Average	Average	Below Average	Very Good	Very Good	Very Good	———
Tipperary	Above Average	Above Average	Good	Very Good	Above Average	Very Good	Very Good	Very Good
Waterford	Very Good	Above Average	Average	Very Good	Above Average	Above Average	Very Good	Very Good
Westmeath	Very Good	Good	Very Good	Very Good	Above Average	Very Good	Very Good	———
Wexford	Very Good	Very Good	Above Average	Very Good	Above Average	Very Good	Very Good	Very Good
Wicklow	Very Good	Above Average	Above Average	Above Average	Above Average	Very Good	Very Good	Very Good

FRUIT CROP REPORT, 1942

The year 1942 proved favourable on the whole from the fruit growers' point of view. In spite of harsh east winds during blossoming time the yields of all fruits were generally up to average, and in the case of apples and plums in particular, very heavy crops were reported from commercial orchards.

Soft fruits suffered to some extent because of drought during May and early June, and the development of apples and pears was retarded by the low temperature during the Summer months.

Pests and diseases were not unduly prevalent during the year but Spur Canker and Blossom Wilt of apples were reported to be on the increase. Late attacks of apple scab developed in many districts, and even in orchards which had received routine spraying earlier in the season.

WEATHER CONDITIONS.

January developed from a mild beginning into unsettled conditions with persistent rainfall later in the month. February was on the whole dry but cold, with harsh winds and night frost.

Conditions in March were not unduly severe, but April and early May were characterised by harsh cold winds which did some damage to the leaves and to fruit flower development. The severe frost on the night of 13th May did not cause undue injury to developing blossoms, but hailstone storms towards the end of the month did considerable damage in a few localities.

The weather in the Summer and early Autumn months was rather cold and at times unsettled. Apple scab developed freely under such conditions and proved difficult to control. No serious gales occurred during the Autumn and apple harvesting was not accompanied by undue losses.

November and December were generally very mild and some Winter spraying was possible before the end of December.

MARKET PRICES.

Apples : *Dessert Varieties.*

Per bushel box.	Early Varieties	11/- to 25/-.
	Mid-Season ,,	15/- to 30/-.
	Late ,,	15/- to 30/-.

Culinary Varieties.

Per bushel box	12/- to 25/-.
Per 5-stone box	Up to 45/-.

Apples for Manufacturing purposes.

Jam Fruit	£6 to £8 per ton.
Cider Fruit	£8 per ton.

Strawberries.

In punnets 1/- to 3/- per lb. up to 4/6d. for earliest supplies.
Jam Fruit 65/4d. to 71/4d. per cwt.

Gooseberries.

From 5/- to 12/- per chip of about 12 lbs.
Jam Fruit 32/8d. per cwt.

Raspberries.

In punnets 1/- to 1/8d. per lb.
Jam Fruit 62/- per cwt.

Black Currants.

In punnets 10d. to 1/4d. per lb.
Jam Fruit 74/8d. per cwt.

Plums and Damsons.

Plums 5/6d. to 18/6d. per chip of about 12 lbs.
Damsons 3/- to 7/6d. per chip of about 12 lbs.

COMPOST.

Apart from the water, air and living organisms present, soil consists of a mixture of mineral matter, such as stones, sand, silt and clay, which is derived from rocks, and organic matter, which is derived from the remains of plants, animals and soil organisms. When organic matter such as stubble and roots of cereals, turnip and mangel tops, green manure, etc., is added to the soil, it is decomposed by the activity of the soil organisms into a dark-brown, gelatinous, absorbent substance, which is referred to as humus.

By collecting the finer soil particles into larger crumb-like aggregates, humus facilitates natural drainage and the circulation of air in the soil and thus helps to "lighten" stiff clay soils and make them warmer and more easily cultivated. These results are favourable to the health and activity of the plant roots and micro-organisms in the soil, and generally, conducive to fertility. Humus also absorbs and helps to retain, within reach of the roots of the crop, available plant nutrients and moisture. Its presence is, therefore, of value in all soils, but particularly so in light, sandy soils. Furthermore, the organic matter from which humus is derived contains appreciable quantities of all plant nutrients which are converted during decomposition into a form in which they can be utilised by the crop.

The benefits which are conferred on the soil by decomposed organic matter, while they may appear trivial when considered separately, make in the aggregate a very important contribution to soil fertility. Soils containing a good stock of humus and a fair proportion of decomposing organic matter, in which a sweet condition is maintained by liming as required, constitute the best medium for the activity of beneficial micro-organisms and the growth of crops.

The making of compost, which is a valuable source of humus, from all suitable organic refuse can, therefore, be recommended to farmer and gardener alike as a practice which gives a good return for the labour and expense involved. The burning of such refuse is to be condemned for it results in the loss of the valuable humus which it is capable of producing. The practice of allowing refuse to remain scattered and exposed to the weather to undergo slow decomposition at low temperatures is equally undesirable as, apart from the fact that it facilitates the propagation of disease organisms and pests, much of the manurial value of the material is lost.

Raw Materials for Compost:

With certain exceptions to be mentioned presently, all organic refuse

procurable, such as chaff, weeds, fallen leaves, etc., ought to be collected for composting.

Plant refuse bearing disease organisms in the resting forms which might survive the composting and cause subsequent spread of the disease should be excluded. Examples of such material are: potato tubers affected by Wart Disease, potato stalks to which the flattish, dark resting bodies (Sclerotia) of certain stalk diseases are attached, swedes and cabbages affected by Club Root or Finger-and-Toe disease, "roots," such as swedes and mangels, affected by Dry Rot, celery leaves affected by Leaf Spot or Blight, and onions attacked by Onion Mildew.

Most weed seeds are destroyed by the conditions which exist in the bulk of the ideal compost heap. It is difficult, however, to ensure that all seeds going into the ordinary compost heap are exposed to such conditions and some seeds in the exterior and in pockets of the heap may, despite the turning of the latter, escape destruction. Soils normally contain a large stock of weed seeds lying dormant until they are, by cultivation, brought near the surface into conditions favourable for their germination. As a rule, the seeds of one or more species of annual weed such as charlock, poppy, chickweed, etc., predominate in this dormant stock and in the case of such species, the addition of the relatively few which survive in the compost makes little difference in practice to the subsequent condition of the land as regards prevalence of weeds or extent of control measures which must be adopted. In the case, however, of weed species difficult to control, such as docks, the addition of a relatively small number of seeds might later involve the farmer in considerable labour and expense in eradication, particularly where control is neglected until they are well established. It is, therefore, in practice a wise precaution to exclude from the compost heap material containing a large proportion of definitely objectionable or mixed unknown weed seeds, such as the effluent of the seeds' chutes of the threshing mill and winnower.

Organic material considered unfit for composting should be burned and the ash used directly as manure or added to the compost heap.

The quantity of inorganic matter, such as mud, sand and gravel, cinders, etc., included should also be the least possible, as material of this type adversely affects the aeration and heating of the heap, adds to the cost of handling and lowers the manurial value of the final product.

Making up the Heap:

The decomposition of organic refuse to compost is brought about by organisms which are predominantly of the type that requires a plentiful supply of fresh air. A certain degree of moistness of the mass is also essential to their activity. Further, this decomposition involves the production of acids whose accumulation, if they are not neutralised or absorbed so as to render them harmless, would inhibit the work of the

organisms and retard decomposition. A knowledge of these facts enables provision to be made in the making up of the heap for the conditions most favourable to decomposition. Upon them is based the old and well-known practice of preparing the heap of pasture top-dressing by mixing material cleared out of watercourses and off the road sides with chaff, vegetable refuse and all such material considered unfit for addition to the farmyard manure heap, and its turning and mixing with lime later some time before spreading on the land.

The site of the compost heap may be on the level surface of the soil, preferably in a situation such as under trees in the corner of a field or garden or in a grove, where protection from cold drying winds and sunshine is afforded.

The aim should be to lay down a good bulk of material together rather than to build it up over a long period by the addition, at intervals, of small quantities of material. In summer or early autumn when vegetable refuse is most plentiful, the atmosphere warm and the moisture content of the heap most readily controlled, is the best time of year for setting up the compost heap in this country. Fresh green material should be allowed to wilt and dried materials like straw, chaff and others of the litter type which cannot be utilised as such, should if they are to form a large part of the heap, be spread in stock passages to be trampled upon or soaked in cess-pools, so as to get them thoroughly wetted before composting.

The compost heap is commenced by shaking out a layer of organic refuse (chaff, weeds, leaves, etc.) about 6 to 9 inches deep according to the type of material used—the coarser and looser the material the greater the depth of the layer may be—some finely slaked lime or ground limestone being sprinkled through it at the same time. A light layer of farmyard manure or old compost—an inch or two deep—is added, or a sprinkling of liquid manure, if available, might be used instead. This is followed by about an inch of fine soil. If liquid manure is used, the slaked lime should be mixed through the soil instead of being applied directly to the refuse. This sequence is repeated until a height of 3 to 5 feet is reached, the last or top layer being of soil a couple of inches deep. The soil used should be good, loamy, surface soil. It serves to absorb any ammonia produced and to minimise loss of moisture by evaporation.

The various types of organic refuse are mixed together as intimately as possible before proceeding to make up the heap or as each layer is spread. Any material which is dry should be sprinkled with water until moist but a wet or saturated condition of any portion of the heap must be avoided. If liquid manure or liquid from a cess-pool is available, it might be used with advantage for this purpose. Care should be taken throughout that the heap is built up loosely—close packing should be avoided. If necessary it can be made in sections of a couple of yards wide at a time. Only when the mixed refuse is stemmy and so open that the maintenance

of a moist condition is rendered difficult, would some degree of compaction by trampling be desirable.

Turning:

Shortly after it has been made up the mass develops a greater or less degree of heat according to the suitability of conditions for the multiplication and activity of the organisms present. If conditions are good, considerable heat is generated. This gradually eases off, accompanied by a shrinkage in volume, and when it has cooled down—usually after about 3 to 6 weeks—the heap should be turned so as to get the contents thoroughly mixed and loosened up again to admit a fresh supply of air and promote further heating and decomposition. As the heap is turned, the exterior should be mixed into the interior of the new heap and any dry material encountered moistened and dispersed. Further turning may be necessary in order to obtain the right type of product but usually two or three turnings will suffice.

The Product:

The finished compost should be homogeneous, dark-brown, crumby and friable, with an earthy smell, and any fragments which resisted decomposition to this condition should be left aside for further composting. Compost contains, in a form in which they quickly become available to plants, the manurial constituents of the original refuse together with a variable but appreciable quantity of nitrogen fixed from the atmosphere. It is lower in water content and richer in organic matter than farmyard manure with which it is comparable in manurial value. It may therefore be used as a substitute for farmyard manure and, if similar results are to be obtained, it should be applied at the same rate.

Continued exposure of the material after it is prepared to leaching by rain results in loss of manurial value and it is, therefore, best applied to the soil as soon as possible after it is ready for use.

The Indore Process of Compost Making:

The main essentials for the decomposition of organic refuse to compost, namely, air, moisture, suitable reaction and nutrients such as nitrogen and phosphate for the active organisms, are the same in all cases. The provision of these essentials may, however, be best achieved by somewhat different methods of procedure according to conditions of climate, labour supply, nature of materials available, farming practice, etc. Special methods of making compost have, therefore, been devised to suit special circumstances. The Indore Process is one such method which has been found suitable to conditions in India where it originated. In principle, however, it does not differ from the system usually practised here as described in this leaflet.

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THE EFFICIENCY OF SPRAY TREATMENT AS A REMEDY FOR BORON DEFICIENCY IN SUGAR BEET AND SWEDES AND FOR MANGANESE DEFICIENCY IN OATS.

By

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Occurrence of Boron Deficiencies in Sugar Beet and Swedes in South County Kildare.

From the early years of beet cultivation for sugar production in this country the disease known as Crown Rot has appeared, it having been recorded in 1928 by Gallagher (1) as being of serious consequence on alkaline soils here. Subsequent to the discovery of a preventative and cure boron, usually in the form of borax, has been widely used. This fact precludes the possibility of making a comprehensive survey of the district with a view to ascertaining the areas on which the disease occurs. Sufficient data have, however, been obtained to enable a general conclusion to be drawn—that there is grave danger that the disease will occur on naturally alkaline and recently limed soils here. It is well known that soils of a mechanically light nature and those subject to drought suffer more severely. As a large proportion of the soils of the area are "light" and alkaline the necessity of taking adequate steps to prevent this disease is obvious. Though records of its occurrence on acid soils, where an actual rather than an induced deficiency is encountered, are available, the disease has not been noted in such soils in this county. Instances where the application of lime to acid soils have induced boron deficiency in sugar beet, are known to the writer. A recent observation in this connecton is deemed of sufficient interest for inclusion here. Burnt lime at the rates of 8 cwt. and 16 cwt. per acre was applied to adjacent plots prior to sowing this crop. Normal plants developed in the area which received the smaller application and a yield of 12 - 13 tons per statute acre was obtained. Crown rot affected approximately 50 per cent. of the plants in the area of larger lime application and a yield of 6 tons was produced. The soil reaction (colorimetric method) after the crop was harvested was shown to be just neutral (pH 7.0) in the former and definitely alkaline in the latter areas. Caution in the use of lime for this crop is advised, as the ideal medium for growth is slightly acid (between pH 5.8 and pH 7.0 approximately), an increase in reaction beyond the neutral point being both unnecessary and undesirable.

Attention has been drawn to the distribution and economic importance of the disease known as "brown heart" in swedes in this country by Walsh (3) recently. This worker noted its occurrence in both alkaline and acid soils in Co. Dublin. Observations indicate that it is of widespread distribution in Co. Kildare, being more prevalent than the kindred trouble in sugar beet. The conditions influencing both diseases are somewhat similar.

While it has been calculated that 2lb. of borax per statute acre will supply the boron requirements of a normal crop of sugar beet, experiments in this country, indicate that an application to the soil of approximately ten times this quantity, along with that already contained therein, is necessary to prevent "crown rot" where the disease is likely to appear. Applications of similar amounts to prevent "brown heart" in swedes would appear to be generally necessary from research conducted elsewhere. As boron is easily immobilised in alkaline soils such large applications are necessary. The experiments reported on hereunder were designed to compare the efficiency of spraying small quantities of borax on to the foliage of sugar beet and swede crops at mid-season with that of larger dressings applied to the soil.

FIELD EXPERIMENTS.

Brown Heart in Swedes: This disease affected about 90 per cent. of the swede "bulbs" on an alkaline light loam soil at Kilberry in 1940. In the following year an experiment was conducted in another portion of this field as follows:—

Borax was applied at sowing time (May 15th) broadcast on to the soil and harrowed in, at the rate of 21lbs. per statute acre and a similar quantity was applied at the side of the bulbs on July 23rd to a second plot, while a third had borax at the rate of 7½lb. per statute acre (1lb. dissolved in 10 gallons of water) sprayed on to the foliage at the latter date. A "spreader" was included in this mixture. A control plot was also included. Each of the plots comprised an area of 1/20th of a statute acre. Farmyard manure was applied evenly in the drills over the experimental area. The soil in the control area had 3.8 per cent. carbonates.

As the absence of easily recognizable external symptoms is a characteristic feature of this disease observations on its relative occurrence in the various plots were unavailable until the crop was pulled on October 30th. An examination of the "bulbs," which were cut at this date, showed that infection was severe on the control plot and present to some extent in the others. The percentages of diseased swedes in the various plots are tabulated hereunder together with the soil reaction and treatments.

TABLE I.

Plot No.	1	2	3	4
pH of Soil	8.0	8.1	7.9	7.8
Lbs. borax applied ...	$7\frac{1}{2}$	21	—	21
Method and time of application ..	Sprayed July	To soil July	—	To soil sowing time
% "brown heart" in bulbs	17	19	66	22

Crown Rot in Sugar Beet: This disease having appeared on a crop at Kildangan in the last week of July, 1942, an experiment was laid down on August 11th. The disease had become severe at the latter date, some plants having been completely defoliated. An area over which the disease was uniformly severe was divided into three plots and treated as follows: Plot 1 had borax applied to the soil at the rate of 20lbs. per statute acre, plot 2 served as a control, while plot 3 had borax at the rate of 5lbs. per statute acre (1lb. to 20 gallons of water) sprayed on to the foliage. Each of the plots comprised an area of 1/40th of a statute acre. A "spreader" was included in the spraying mixture. The soil over this area had a reaction of pH 7.9.

Plants growing on plots 1 and 3 began to recover in about 10 to 14 days and appeared much superior to the control at 22 days after treatment. Plot 3 recovered more quickly and looked healthier at this time. Leaves had again appeared on the majority of the defoliated plants in these plots. Some slight recovery was evident in the control plot following showery weather. Plants on the treated plots progressed very well and the crop was pulled on November 2nd. The yield of roots (crowned) per statute acre on the various plots at this date were as follows:

	Tons	Cwt.
Borax 20lb. per acre (to soil)	8	11
Control	6	10
Borax 5lb. per acre (sprayed)	8	8

DISCUSSION

The results of these two preliminary experiments indicate that applications of borax by spraying in relatively small quantities, on to the foliage of sugar beet and swede crops, are as efficient in reducing the diseases caused by an absence of boron in these crops as are much larger quantities applied to the soil. The results, however, are by no means conclusive for the swede crop since the application of $7\frac{1}{2}$lb. of borax by spraying in July failed to eliminate "brown heart," though it was successful in reducing

it to the same degree as did 21lb. applied to the soil then or at sowing time. It is probable, too, that larger dressings of borax than those applied would be necessary to prevent the trouble in this soil.

The application of small quantities of borax by spraying would appear to have many advantages over its application to the soil viz. (i) it is more economical of borax and can be applied more uniformily; (ii) it has a quicker recovering effect by eliminating the 'time lag' resulting from its application to the soil and generally obviating possible immobilisation; (iii) should be much more efficient when drought is experienced after treatment.

It is interesting to record that a crop of mangolds growing adjacent to sugar beet at Kildangan in 1942 exhibited "crown rot" symptoms a month later than did sugar beet and responded to a borax dressing (21lb. per acre to the soil). This instance verifies the already known point that the mangold is less susceptible to boron deficiency than sugar beet. Further a crop of swedes growing immediately adjacent to the affected mangolds showed about 95 per cent. "brown heart" in November.

Manganese Deficiency in the Oat Crop.

Investigations on the disease known as "Grey speck" of oats conducted by Gallagher and Walsh (2) were recently discussed by Walsh (3) in this Journal. These workers showed that the disease was caused by a deficiency of available manganese in some slightly alkaline grey and black soils as distinct from those of a brown character and indicated that control was obtainable by spraying on a weak solution of manganese sulphate to the oat plants.

The disease has been observed on a small number of soils of a grey brown, mineral, and organic black colour (cut away bog type) in South Co. Kildare. These were plentifully supplied with calcium carbonate and had reactions varying from pH 7.0 to 7.5.

The following is a summary of an experiment in which manganese sulphate at the rate of 10lb. per statute acre was applied by spraying on to areas where the disease was (i) moderately and (ii) very severe in an oat crop at Kildangan on July 4th, 1941. Control plots were left unsprayed in each case. Plants on the treated plots showed improvement in six days and were comparatively healthy in about two weeks after treatment. New growth produced after treatment was healthy. In comparison the oats on the control plots developed severe symptoms of the disease and weeds became prevalent thereon.

The yields of grain and straw obtained on plots of 1 statute perch are submitted here:

TABLE II.

	Disease very severe		Disease moderately severe	
	Unsprayed	Sprayed	Unsprayed	Sprayed
Weight of Grain (lb).	1.7	8.75	3.25	8.125
Weight of Straw (lb.)	7.5	19.25	14.5	21.0

These results, which agree with those of the workers already mentioned, indicate that spraying of the foliage with a 1 per cent. solution of manganese sulphate increased the yields of grain and straw very significantly.

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DISEASED CONDITIONS IN POTATOES AND PEAS ASSOCIATED WITH POTASH DEFICIENCY IN SOUTH COUNTY KILDARE.

By

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The availability of nutrient elements in the soil is reflected by the crops produced thereon. While normal crops are produced on media having optimum concentrations of essential nutrients, subnormal development ensues when deficiencies of any of these exist. Crops which require large amounts of any particular element most readily exhibit disease symptoms when this element is in short supply.

A "browning" of potato foliage due to a deficiency of available potassium has been noted by the writer as being of rather widespread occurrence in South Co. Kildare during the past three seasons—1940, '41 and '42. Disease symptoms in the field pea crop resulting from a like deficiency have also been observed. It is the object of this paper to record some preliminary investigations of these.

The following experimental methods as regards soil and foliage examination were used for investigations on both crops:

Soil examination: Using the soil type as the fundamental unit of examination the relationship of soils which supported diseased and healthy crops were studied. The procedure followed was as described recently by Gallagher and Walsh (2) and Walsh (8). The available nutrient status of surface soil samples examined was determined by the Morgan (6) method.

Foliage examination: The following simple method was used to determine the potassium status of plant foliage. After drying for 24 hours at 105 degrees C one gram of foliage was extracted with a quantity of distilled water to give a solution with concentration of potassium suitable for testing. Ten drops of the solution to be tested were treated with one drop of Formol, and then one drop of potassium A reagent (Morgan). Reagent B (Morgan) was then added drop by drop shaking the mixture a minute or so after each addition. The number of drops necessary to produce a definite permanent cloudiness serves as a fair guide to the quantity of potash present, as follows:—

TABLE I.

Precipitate produced by drops of Reagent B.	Milligrams of K20 per 100 C.C. of Solution.
3 or less drops	5 or more milligrams
4 drops	4 milligrams
6 ,,	3 ,,
8 ,,	2 ,,
16 ,,	1 ,,

·POTATOES.

Field Experiments: "Browning" of potato foliage (variety, Dunbar Rover) was observed by the writer in 1940 on some experimental plots—the main object of which was to compare the efficiency of various methods of application of fertilizers—situated at Moatefield, Athy. The condition was noted at the end of June on plots manured with $6\frac{2}{3}$ cwt. Superphosphate and $1\frac{2}{3}$ cwt. Sulphate of Ammonia per statute acre. Contiguous plots which received similar quantities of these manures and in addition $1\frac{2}{3}$ cwt. Muriate of Potash per statute acre remained healthy until the end of August when they exhibited diseased symptoms. Farmyard manure was not applied to these plots. The soil occurring here is of a grey brown colour on limestone drift, alkaline in reaction and having a loamy texture. It has a high silica/ sesquioxide ratio being similar to that described by Gallagher and Walsh (2) as occurring south of Athy. Potato crops showing disease symptoms, similar to those observed here, were evident on many farms in the area during the months of July, August and September of 1940. On examination the soil types on which these crops grew were shown to be similar to that at Moatefield.

In the following year (1941), experiments which primarily aimed at assessing the standard of fertility, conducted according to the Mitscherlich technique, on three soils similar to that on which "browning" of potato foliage occurred in the previous year provided excellent material for study. These trials were laid down in Latin squares. Four treatments—each replicated four times—supplying various combinations of nitrogen, phosphates and potash were used as follows:—

TABLE II.

	Superphosphate Lbs. per stat. ac.	Sulphate of Potash Lbs. per stat. acre	Sulphate of Ammonia Lbs. per stat. acre.
1.—Complete Manure	640	400	480
2.—Minus Phosphates	——	400	480
3.—Minus Potash	640	——	480
4.—Minus Nitrogen	640	400	——

Farmyard Manure was not applied in these experiments.

The sites on which these experiments were conducted were (i) Moatefield, Athy, (ii) Kilberry, Athy, and (iii) Nurney, Kildare. The plants on the "minus potash" plots exhibited deficiency symptoms at centre (i) in mid June and at centres (ii) and (iii) at mid July. The "complete manure" plots supported healthy plants at all centres except Moatefield until digging time. At the latter centre "browning" was evident on these plots at the end of August, while the "minus phosphate" and "minus nitrogen" plots had shown susceptibility to attack prior to this date. The "minus phosphate" plots at Kilberry exhibited "browning" symptoms by mid August while the "minus nitrogen" plots at this centre showed a mild attack a month later.

As in the previous year the condition mentioned was evident on many potato crops growing in the area. The soil on which these occurred was again of a similar type to that previously described.

In connection with these symptoms it is of interest further to record yet another experiment conducted at Kildangan in 1941. At this centre plots (laid out in Latin square fashion as a potash fertilizer placement experiment) which received 1¾ cwt. of Sulphate of Ammonia and 6¾ cwt. Superphosphate per statute acre as a basic dressing had Sulphate of Potash at the rate of 65lbs. per acre applied—among other ways—(a) broadcast over particular plots and harrowed in before drilling and (b) in continuous bands, placed at each side, about two inches from, and about level with the lower plane of the potato set. It was noted that while the potato plants growing on plots treated as in (a) exhibited "browning" symptoms at the end of July and had completely succumbed to attack by August 20th, those growing on plots treated as in (b) were only slightly affected at the latter date. When weighings were finally made on these plots the yields indicated that plots (a) gave only 67.4 per cent. of the returns obtainable from plots (b).

The condition appeared again in many crops grown under normal farming conditions in 1942, its coincidence with the soil type described being again evident.

Symptoms: The first noticeable symptom is a wrinkling of the leaves on plants which show retarded growth. This is followed by interveinal yellowing of the older leaves and a subsequent "browning" or "bronzing" of the yellow areas on the upper and lower leaf surfaces. A marginal scorch ensues and in badly affected crops these leaves gradually wither. A similar disease cycle occurs in younger leaves. In crops most severely affected the stalks lose turgidity, blacken and die. The plants growing in "minus potash" plots at Moatefield in 1941 had completely succumbed by August 23rd, and at Kilberry and Nurney by mid-September.

The disease symptoms described have very often been attributed to drought. While there is evidence that drought accentuates the trouble when present, the condition is primarily due to a deficiency of available potassium.

Effect on Crop: Consequent on the onset of "browning" growth is inhibited while in badly effected crops the plants die off prematurely. The yields of diseased crops are depressed, the reduction being proportional to the severity of attack. Table III—compiled from field experiments conducted according to the Mitscherlich technique in 1941 already referred to—supplies data to amplify this point and also includes the results of available potash (Morgan) tests of the soils immediately prior to laying down the experiments. The potash status expressed as a percentage of the maximum content shown in the last column of this table has been calculated according to the Mitscherlich method (5).

TABLE III.

Site of Experiment	"Browning" evident	Crop on "minus potash" plots died off by	Potash Content (Morgan)	Yield per Statute acre. "Complete" Tons	Cwt.	"Minus potash" Tons.	Cwt.	Potash status calculated as percentage of maximum.
Moatefield	Mid June	Aug. 23rd	trace	9	0	2	6	25.5
Kilberry ...	Mid July	Mid Sept.	Extra low	19	12	7	4	37.5
Nurney ...	Mid July	Mid Sept.	Extra low	8	6	3	14	44.3

Where the disease appeared in crops grown under normal farming conditions yields were again depressed, reaching a minimum where the condition was most severe. It is notable that where enquiries were made as to the manurial treatment of diseased crops grown under these conditions, it was established that farmyard manure was used in all cases, occasionally supplemented by artificial fertilizers which were mainly or wholly phosphatic. The potash content of farmyard manure varies considerably and may be expected to be least where the liquid manure has not been absorbed by the solid material and where leaching of the manure heap by rain has taken place. The total amount of available potash supplied to the above mentioned crops, where farmyard manure was applied in "fair" to "good" dressings, was not sufficient to prevent deficiency symptoms. When applied

to a soil of "extra low" potash status, farmyard manure with a relatively high nitrogen content, would be expected to induce potash deficiency by disturbing the balance of these elements. The extra phosphates applied as fertilizer to some of these crops would also tend to create a condition of unbalance and induce or further aggravate the condition of deficiency.

It is noteworthy that "browning" can occur when potatoes are grown on lea, an instance having been observed where potatoes were grown on such land, utilized as allotments near Athy. The potash content of the soil here was "extra low." Furthermore the addition of farmyard manure to some of these allotments failed to prevent the onset of potash deficiency symptoms in the first year. The condition was generally much more severe here in the second year. A similar condition was noted by Walsh (8) in Co. Dublin: a severe attack of "browning" occurred on potatoes grown on lea. The potash content of the soil in the latter case was shown to be "extra low" and its potash immobilising power very high.

Distribution of Attack: In the experiments cited the diseased condition appeared uniformly over the plots attacked. Under ordinary farming conditions, however, the incidence of attack varied appreciably, patches of diseased foliage being irregularly placed among otherwise healthy crops. In this connection the condition is somewhat similar to that produced on sugar beet crops by boron deficiency. While differences in the available potash content of soils supporting diseased and healthy foliage would have been expected at planting time large variations were not always exhibited when tests were conducted in the mid or late season, a fact most probably explained by the considerably larger potash uptake of vigorously growing plants. The following examples being representative of a number of tests made demonstrate this point.

TABLE IV.

SITE	Available K_2O in soils sampled end August, 1941.	
	Foliage diseased	Foliage healthy
Bennettsbridge, Athy	Trace	Extra Low
Kilkea, Mageney	Extra Low	Extra Low
Athy	Extra Low	Extra Low

Though tests on soils supporting diseased and healthy plants failed to show large differences in potassium content those made on foliage always exhibited considerable variation. Data for the foliage of crops grown on the soils treated of in table IV are tabulated hereunder together with tests made on foliage from plants growing on "complete manure" and "minus potash" plots at Moatefield in 1941.

TABLE V.

SITE		Percentage K_20 from oven dried foliage from diseased area	healthy area
Bennettsbridge, Athy	...	.45	1.2
Kilkea, Mageney	....	.525	1.2
Athy	....	.45	1.2
Moatefield—1941	....	"Minus Potash" .45	"Complete Manure" 1.2

These results, being representative of a number of tests made, indicate that normal plants have a considerably greater concentration of potassium in the foliage than diseased plants. Normal foliage had from 2 to 3 times as much potassium as diseased in these tests.

Reactions of Varieties: Observations made on crops growing under normal farm conditions indicate that the following varieties are susceptible: Epicure, Duke of York, Sharpes Express, Arran Pilot, British Queen, Up-to-Date, Kerr's Pink, Arran Consul, Arran Banner, Redskin, Gladstone, Shamrock, President, Golden Wonder, Skerry Champion and Dunbar Rover.

While no direct experiments have been laid down to test differences in susceptibility observations made indicate that some such differences exist. Kerr's Pink, for example appeared much more susceptible than Arran Consul when grown in contiguous plots, while Redskin suffered more from attack than either Arran Banner or Gladstone in plots similarly placed at another centre. It was noted also that early varieties were generally more susceptible than maincrop varieties on the same soil. This condition would most probably be related to the quicker growth and tuber development and consequently higher potash demanding effect of the former varieties.

Effect of Soil on onset of "browning": As already indicated, the incidence of "browning" on the foliage of potato crops grown under ordinary farm conditions in this area appears to be coincident with soil type. Observations made on numerous soils examined on which this condition occurred, showed that in essential characteristics these were similar to that described as occurring at Moatefield. Soils of this type extend over approximately 70 per cent. of the mineral soils in the area. The other principal soil type occurring here, and on which no record of potash deficiency in the potato crop has yet been recorded under ordinary farming conditions, is yellow brown in colour, acid in reaction, loam to clay loam in texture and having a much lower SiO_2/R_2O_3 ratio, being closely related in essential features to the "brown earth" type as described by Gallagher and Walsh (2). The explanation of this difference in potash

availability is no doubt in some way closely connected with the constitution of the clay fraction, that of the former type (with a SiO_2/R_2O_3 ratio of 6.7) differing so fundamentally from that of the latter (with a SiO_2/R_2O_3 ratio of 3.2). Similar results have been obtained elsewhere, Bryan (1), and Hester and Shelton (3), demonstrated that availability of potash varied with soil type in America. Walsh (8) noted large differences in potash availability from soils of different type where the available potash status was originally equal and indicated its close relationship to soil texture.

DISCUSSION.

The results obtained from these preliminary investigations indicate a close correlation between very low potash availability, as measured by chemical methods, in the soil and the "browning" symptoms of potato foliage described. Similar symptoms, indicative of potassium deficiency in this crop, have been described by various workers. The accentuated and early deficiency exhibited by the "minus potash" plots, in the experiments cited here, is explained by the degree of unbalance caused by the inclusion of nitrogen and phosphates. Knowles, Watkin and Cowie (4) demonstrated that the interaction of these two elements induces a decreased absorption of potassium. Of interest in this connection is the observation drawn from the field trial at Kilberry in 1941 that excess nitrogen (in the "minus phosphate" plots) is more potent than excess phosphates (in "minus nitrogen" plots) in inducing deficiency. This conclusion agrees with that reached by the workers already mentioned. Again the addition of phosphates (as phosphatic fertilizer) to a soil with very low potassium content and in which the nitrogen status is high would develop a similar condition in the potato crop. This condition of unbalance has doubtless obtained in some of the potato crops grown under normal farm conditions in the area, where the manures used were farmyard and phosphatic.

The results presented are of interest from the point of view of the method of application of fertilizers. "Browning" occurs earlier with consequent reduction in yield, when the potash fertilizer used in small quantities is broadcast on the soil and harrowed-in before drilling than when applied in localized strips near the potato in the drill. Immobilisation of potash by the soil is greatly facilitated by the former practise while the plant must develop a more extensive root system to obtain its food when so applied. Further work on fertilizer placement will be submitted in a later paper. It is sufficient to record here that the localized placement of this fertilizer has proved superior, from the point of view of crop yields, to any other method tested.

While differences in the amount of available potash were not always evident when tests were conducted by the Morgan method in soils supporting diseased and healthy foliage in August, variations would have been expected if tests were conducted at planting time. The higher potassium

absorption of healthy plants, in ordinary farms where observations were made, would tend to reduce considerably the amount of this element available in the mid or late season. The potash status here might, therefore, be no greater at this stage than that of the areas where plants were diseased.

The utilization of tests on foliage proved an invaluable means of detecting deficiency. Significant differences in potassium content of diseased and healthy foliage were obtained by the method used. Normal foliage had 1.2 per cent. K_2O while diseased had only 40 per cent. of this quantity approximately.

The possible significance of drought in developing or accentuating potash deficiency has been previously discussed in this Journal by Walsh (7). In this connection, it is of interest to note that many of the soils in which the condition was observed in the area were subject to drought. Moreover, where potatoes were grown in ridges the condition was noted to be worst on the edges of ridges where drying out would necessarily be more severe.

Control: It is obvious that successful scientific methods towards preventing this condition are to be achieved through the medium of soil testing technique. It has been established that the trouble is associated with an "extra low" potash status of the soil, as measured by chemical methods, and that an application of potassic fertilizer in adequate quantity maintains a healthy crop; so a knowledge of the potash status is essential. Moreover, information on the nitrogen and phosphate contents of the soil is necessary since an excess, relatively, of these can induce potassium deficiency. Comparatively simple methods designed to indicate the mineral status of a soil, and the amount of potassium necessary for maximum normal growth, are available. These have been described previously in this Journal by Walsh (8). Haphazard manurial trials are therefore to be avoided.

The more ordered use of potassic fertilizers for this crop would undoubtedly lead to larger potato yields in this area. Their application to the soil in a localized placement manner, where they are easily assessible to plant roots and where immobilization by soil is minimised, is recommended.

FIELD PEAS.

Introduction: A diseased condition of the field pea crop, afterwards shown to be associated with deficiency of available potassium, was first observed by the writer at Russelstown, Athy, on July 1st, 1941. The field of 15 statute acres was sown with the Marrowfat variety in March. The crop was grown after corn and manured with 6 cwt. of superphosphate per statute acre at sowing time.

It was noted on entering the field that the pea plants were, in a small

area—the site of a manure heap two years previously, normal in size, (15″-16″ high), vigour and the number of pods borne. These plants were profusely supplied with nodules. Approximately 50 per cent. of the field supported plants which were very much stunted in growth (4″-6″ high). The top leaves had a greyish green colour by comparison with the healthy plants. The lower (older) leaves showed a chlorotic condition, had developed a scorch of the tip and some were dying off. Pods were relatively absent from these plants. The rooting system of these was poorly developed and, except very occasionally, nodules were absent.

Soil type: The soil type occurring here is grey brown in colour, alkaline and light loam in texture. It has a high SiO_2/R_2O_3 ratio being similar to that described as occurring at Moatefield.

Soil and foliar analyses: Tests conducted on soil samples (Morgan method) at this stage, from areas where plants were healthy and diseased, indicated that while the potassium content did not vary, being "extra low" in both, the nitrate nitrogen and phosphorus contents were somewhat higher in the latter case. The actual readings for these were: nitrates—"Low" to "Medium" in the area of healthy plants and "high" in area of poor growth, phosphates—"low" to "medium" in the former and "medium" in the latter areas. The status of all the other elements and reaction were similar for both areas. The potassium content of the pea foliage from diseased and healthy areas varied considerably, as follows: K_2O (Ovendried).

Diseased foliage	.3 per cent.
Healthy foliage	.6 per cent.

EXPERIMENTAL.

Field Experiments: A series of manures were applied (watered in) to areas where the condition described was most severe on July 2nd. The applications of the various manures made were as follows:—

Sulphate of Ammonia	at the rate of 3 cwt.	per statute acre.
Superphosphate	,, ,, ,, ,, 4 ,,	,, ,, ,,
Sulphate of Potash	,, ,, ,, ,, 5 ,,	,, ,, ,,

The nitrogenous manure was included as the owner of the field contended that a small application of a nitrogenous manure previously applied effected some improvement. The following table (VI) indicates the treatment given to the various plots.

TABLE VI.

PLOT 1	2	3	4	5	6	7
Sulphate of Ammonia	Sulphate of Potash	Control	Sul. of Amm. Superphosphate Sul. of Potash	Sul. of Amm. Superphos.	Superphos. Sul. of potash	Sul. of Amm. Su. of Potash

In approximately one week after treatment the peas on all the plots which received a dressing of potash (Plots 2, 4, 6 and 7) began to recover and were normal in appearance about three weeks after treatment. Pods were produced on these plants and an average crop was anticipated. The condition of the plants on all the other plots became worse, the older leaves developed a scorch of the tip and began to wither, while a more severe chlorosis became pronounced on the younger leaves. Many of the plants in these plots had died off by August 20th. Plate I indicates the appearance of typical plants from plots with and without added potash at mid August.

The yields of dried peas on these plots (1 statute perch in area) which were harvested on September 6th were as follows:—

TABLE VII.

PLOT	1	2	3	4	5	6	7
Lbs. of Peas	.5	11.5	.5	9.5	.75	8.75 *	10.0

* The plants on this plot were accidentally pulled by farm workers on August 18th and were weighed when dry.

The procedure, observations and results of a second experiment conducted on this field are outlined hereunder.

TABLE VIII.

PLOT 1	2	3	4	5	6	7
Sulphate of Potash	Sul te of Ammonia	Control	Sul. of Amm. Superphos.	Sul. of Amm. Sul. of Potash	Sul. of potash Superphos.	Sul. of Amm. Sul. of Potash Superphos.

Some peas were pulled from a badly affected area, the soil was dug and peas were sown on July 3rd in plots manured as follows:—

The rates of treatment of the manures used here were increased by 50 per cent. on those used in the previous experiment. All plots were watered immediately after sowing.

No difference was observed between the various plots which germinated and appeared overground evenly until August 12th on which date subnormal growth became evident on the control plot. On August 16th plot No. 4 (Sul. of Amm. and Superphosphate) showed a similar condition while on August 19th the trouble had begun to appear on plot No. 2 (Sul. of Ammonia).

Symptoms: The first observations on these plots indicated a retard-

ation of growth of the plants, and the development of a chlorotic condition. Leaves of these plants assumed a greyish hue when viewed from a distance of 10 to 20 yards. The condition worsened as the plants grew, older leaves developed a scorch of the tip and began to wither while younger leaves became chlorotic and scorched in time. Pods were relatively few on these plants. Their height did not exceed 5″ at any time and many of these had died off by the end of September.

In contrast to these the plants on all the other plots (those which received potash) grew and developed normally. Pods were set by mid September on plants which at this date reached an average height of 17″.

An examination of the rooting systems of plants growing on the various plots indicated that more extensive roots were produced by plants which received an application of potash. Nodulation was normal on these plots but almost completely absent in plots which did not receive dressings of potash. Plate 2 shows the rooting systems of typical plants from plots Nos. 1 and 3.

Foliar Analysis: Determinations of the potash content of the foliage of peas growing on plots Nos. 3 and 7 which were made early in October are shown here. K_2O (ovendried).

Plot 3 (Control)	.25 per cent.
Plot 7 (N. P_2O_5 & K_2O)	.6 per cent.

The amount of potash in the healthy foliage was as in the previous case .6 per cent. while that in subnormally developed foliage was only 40 per cent. of that figure. These figures held good for a number of tests made on foliage from control plots and those which received potash.

Yields: As it was not expected that these peas would mature properly the plots were harvested (by cutting about 1″ above ground level) on October 6th and the total foliage was weighed. The weights of material produced on each plot of 1 statute perch were as follows:—

TABLE IX.

PLOT	1	2	3	4	5	6	7
Lbs. of Foliage	88	38	29	34	90	121	128

Some other instances of potassium deficiency in the pea crop were observed in 1941 while further instances were recorded in 1942 in South Co. Kildare. Again the injury was associated with the soil type already mentioned. Some analysis which were done in these cases indicated that

the condition was coincident with an "extra low" or "trace" potash status of the soil. Foliar analyses revealed differences in potash content of the order already recorded, i.e., diseased foliage had from 40 per cent. to 50 per cent. of the potash contained in healthy foliage.

DISCUSSION.

It is noteworthy that the condition of the field pea crop was observed where the potash content of the soil was "extra low" (Morgan) and where the nitrate nitrogen and phosphate contents were "high" and "medium" respectively. Further the application of nitrogen and phosphates singly or together (plots 6, 7 & 4) along with potash in the first experiment seemed to depress the yield as compared with that obtained from a potash application (plot 2). These points lend support to those already discussed in dealing with potassium deficiency in potatoes. Similar general conclusions, taking the weights of foliage produced into consideration only, cannot be drawn from the second experiment described here, though it must be recorded that podding appeared much more profuse on the first plot (it received potash only) than on any other. Again the inclusion of phosphates as well as nitrogen (plot 4) induced deficiency more quickly than when the latter only was added (plot 2).

All soils examined in which this disease condition appeared were texturally, loams or light loams, and their drainage conditions were such as to predispose to drought.

Control: The remarks appended under this heading when dealing with potassium deficiency in potatoes are applicable here.

ACKNOWLEDGMENTS.

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PLATE I.

A. B.

Typical plants of experimental plots :—see text.
A.—received a potash dressing.
B.—did not receive a potash dressing.

PLATE II.

A. B.

Rooting systems and nodulation of typical plants from experimental plots—see text.

A.—received potash dressing.
B.—did not receive a potash dressing.

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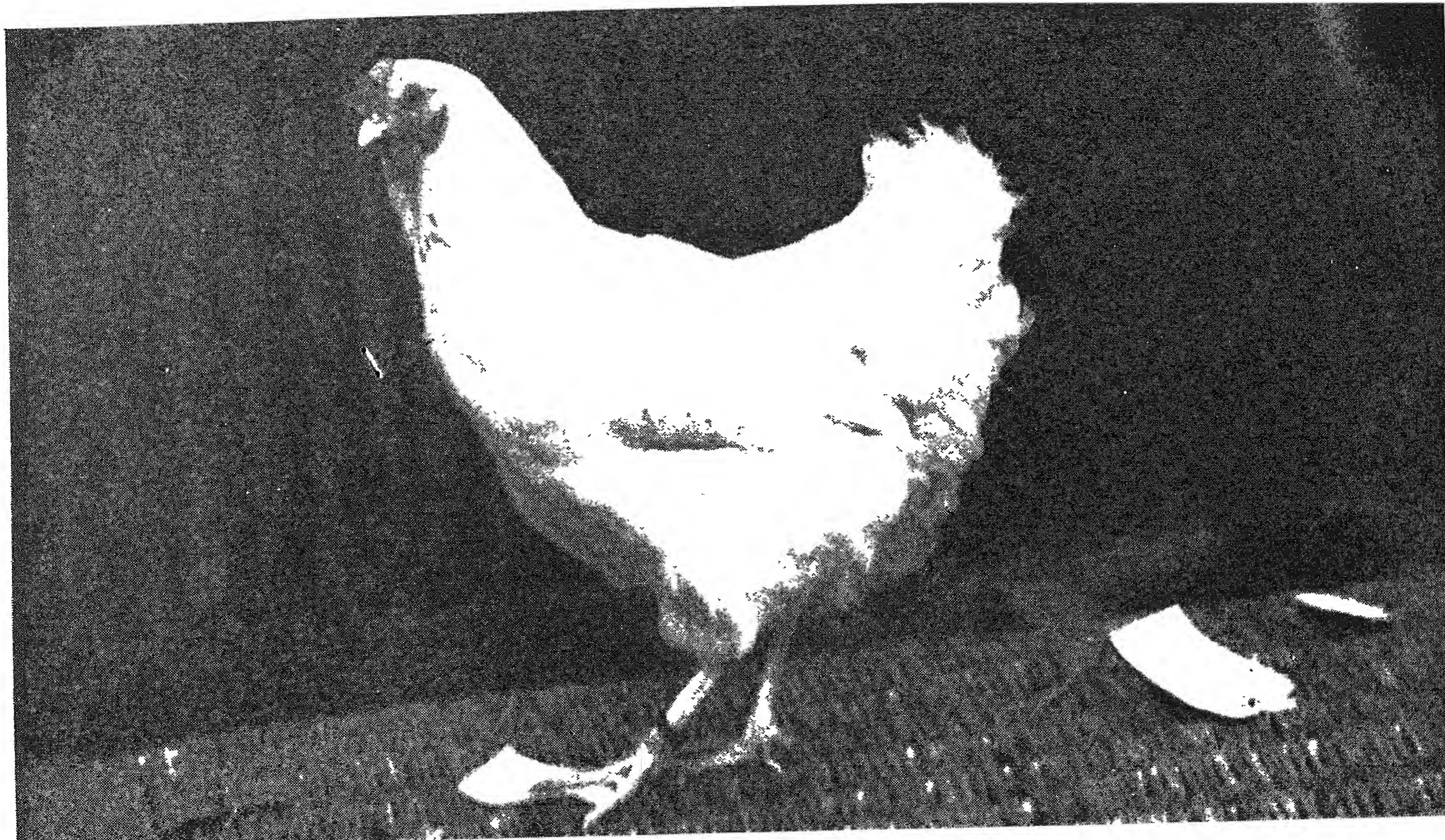
NATIONAL EGG-LAYING TEST, 1941-42.



PULLET NO. 79 (Pen No. 15 White Wyandotte).—Awarded the Special Prize for the pullet (sitting breed) laying the highest number of first grade eggs during the Test.

PEN NO. 15 (White Wyandotte) owned by MRS. E. HILLIS, Corrush, Doohamlet Castleblayney, Co. Monaghan, which won the Silver Cup

NATIONAL EGG-LAYING TEST, 1941-42

The Thirtieth Egg-Laying Test, conducted by the Department of Agriculture, was held at the Munster Institute, Cork, during a period of 46 weeks, beginning on 1st October, 1941, and ending on 18th August, 1942. A total of 73 pens, each consisting of six pullets, having fulfilled the required conditions, was accepted and arranged in Sections as follows :—

Section	I.—White Wyandotte	6 pens
Section	II.—White Wyandotte (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1941)	19 ,,
Section	III.—Rhode Island Red	16 ,,
Section	IV.—Rhode Island Red (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1941)	17 ,,
Section	V.—Any non-sitting breed	8 ,,
Section	VI.—Any other general purpose breed	7 ,,

Station holders were, as heretofore, allowed to enter a second pen in one of the open sections on payment of the requisite entry fee.

Only pullets which were certified by the Veterinary College, Ballsbridge, Dublin, as being non-reactors to the agglutination test for bacillary white diarrhoea, were accepted.

Minimum Weights. The following were the prescribed minimum weights for the respective breeds :—

All non-sitting breeds	3½ lb.
White Wyandotte	4½ lb.
Rhode Island Red	4½ lb.
Plymouth Rocks	5 lb.
Sussex	5½ lb.
Any other sitting breed	5½ lb.

Eggs were graded as follows :—

Egg Grades.

Special Grade.—$2\frac{1}{8}$ oz. and over for the first eight weeks (1st October to 25th November, inclusive) $2\frac{1}{4}$ oz. and over throughout the remainder of the test.

First Grade.—A minimum of $1\frac{15}{16}$ oz. for the first eight weeks, a minimum of 2 oz. during the remainder of the test.

Second Grade.—Eggs which were not more than $\frac{1}{4}$ oz. less than the minimum weight prescribed for first grade eggs in the same period. Eggs which weighed less than the minimum weight prescribed for second grade eggs were recorded separately, but were not included in the score total on which awards were based.

Egg Yields.

Making no allowance for deaths, the average number of eggs per pullet was 177.3. The average number of eggs per pullet for which a record for the full 46-week period was available was 188.6 (see Table II.). The corresponding figures in the previous test were 178.5 and 186.5 respectively. The average production per pullet during each of the twelve periods for each breed is given in Table III. One White Wyandotte pullet laid only one egg during the test.

Egg Size.

Thirteen pens were disqualified for producing more than 20 per cent. of second grade eggs. This figure was twenty-one for the previous test.

Egg Weights.

The average weight of egg for each of the competing breeds is listed in Table IV. The average weight per dozen eggs for all breeds was 26.1 oz., as compared with 26.0 oz. for the previous test. In Table V are given the number and percentage of the different grades of eggs for each breed in respect of pullets which completed the full 46-week period.

Eggs under the Prescribed Weight for Second Grade.

The number of ungraded eggs laid by pullets of each breed which completed the full 46-week period is given in Table VII. The number of such pullets of all breeds which laid ungraded eggs was 95 and the number of ungraded eggs produced by them was 199. The corresponding figures for the previous test were 140 and 415 respectively.

Copper Rings.

Of the 397 birds which completed the full 46-week period, 98 or 24.7 per cent. laid 200 or more first grade eggs and not more than 20 per cent. second grade (see Table VIII). Of these, 70 were leg-banded with numbered sealed copper rings (see

Table IX). Copper rings were withheld from the following 28 birds which were not suitable for breeding purposes :—

(*a*) Breed Standard Defects :—

5 White Wyandotte.
11 Rhode Island Red.
1 Light Sussex.

(*b*) Under Prescribed Weight at Conclusion of Test :—

1 Light Sussex.

(*c*) Consistent Producers of Defective Eggs :—

7 White Wyandotte.

(*d*) Constitutional Defects :

3 White Wyandotte.

The rings were distributed as follows :—

2 pens	....	Five copper rings each.
1 pen	...	Four ,, ,,
7 pens	.. ..	Three ,, ,, ,,
8 ,,	. ..	Two ,, ,, ,,
19 ,,	. .	One copper ring ,,

The egg records for birds which were awarded copper rings are shown in Table IX.

Certificates of Merit.

A total of 132 birds, representing 33.2 per cent. of the number surviving the full period of the test, qualified for certificates. Of these, 70 birds (17.6 per cent.) were awarded Special Certificates (see Table IX), and 62 birds (15.6 per cent.) Certificates (see Table X.)

Certificates were not awarded for pullets which produced over 20 per cent. of second grade eggs, nor for those showing breed or other defects.

Mortality.

During the course of the test 41 birds died, representing a mortality of 9.4 per cent., and an increase of one per cent. as compared with the previous test. The deaths were, as usual, confined to a small proportion of the pens, those occurring in five being accountable for

39 per cent. of the total. The distribution of total deaths amongst pens was as follows :—

1 pen	...	4 deaths.
4 pens	...	3 ,, each.
3 ,,	..	2 ,, ,,
19 ,,	...	1 death ,,

In the remaining 46 pens all birds completed the test. Table XII gives particulars of the pullets that died and the cause of death in each case. Analysis of the causes of death shows that, as in previous tests, peritonitis and oviductitis were responsible for the greater proportion of the mortality.

B.W.D. Test. All birds alive at the conclusion of the test were submitted to the agglutination test for bacillary white diarrhoea, and there were no reactors.

Feeding. The system of feeding was similar to that in previous tests. The birds were fed three times daily. The morning feed consisted of half the grain ration given as scratch feed in the litter, the mid-day feed of wet mash, and the evening feed of the remainder of the grain ration fed in troughs. Dry mash was fed *ad lib.* The mash, both dry and wet, was made up to the following formula :—

4 parts by weight	Maize Meal.
3 ,,	,,	Rolled Oats.
3 ,,	,,	Barley Meal.
1 part	,,	Fish Meal.

The grain mixture consisted of equal parts of oats and cracked maize. Vegetables and roots such as cabbage, kale, turnips and mangels, were fed during winter and spring, and limestone grit was allowed *ad lib.* The following quantities of foods were consumed :—

Mixed Meals	28,952 lb.
Grain	16,576 ,,
Limestone Grit	672 ,,

NOTES ON COMPETING BREEDS.

WHITE WYANDOTTE.

Sections I and II. The majority of the twenty-five pens of this breed were made up of typical well-developed birds. In some of the pens there were individual birds which were undersized on arrival at the test and these took a long time to come into production. Birds with abnormal eye colour were included in a few pens. Production and egg size

were very satisfactory but egg quality in some pens was not up to standard. Mortality in the breed was slightly higher than in the previous test. The winning pen (No. 15) in Section II, owned by Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, won the silver cup. The six birds, which were good specimens of the breed, laid 1,479 eggs of which only 24 were second grade.

RHODE ISLAND RED.

Sections III and IV.

With some exceptions the thirty-three pens in these sections were satisfactory in respect of type, colour and development. A few individual birds were immature on arrival and consequently slow in coming into production. Egg production in the breed was slightly lower than in the previous test, but egg size and quality were satisfactory. Mortality was very low.

ANY NON-SITTING BREED.

Section V.

The eight White Leghorn pens comprising this section were generally of good quality, but three of them were backward and slow in coming to maturity. Moulting was prevalent in the early periods and consequently production was low but reached a very satisfactory level for the full period of the test. Mortality was higher than in the previous test when it was only 2.8 per cent.

ANY OTHER GENERAL PURPOSE BREED.

Section VI.

This section was composed of five pens of Light Sussex, one of Barred Plymouth Rocks and one of Buff Plymouth Rocks. Most of the Light Sussex were good specimens of the breed but some individuals were under-developed on arrival and did not subsequently attain satisfactory weight. The Barred and Buff Plymouth Rocks were well-developed birds of good colour. Production and egg quality were satisfactory in this section, but egg size was poor in some of the pens. Mortality was somewhat lower than in the previous test.

CONCLUSION.

The results of the test were very satisfactory especially when the prevailing difficulties are considered. The performance of the birds generally was of a high standard, but some competitors might have exercised greater care in the selection of their entries. Birds showing breed or physical defects should not be sent to the test as they will not make satisfactory breeding stock even if they prove good layers.

TABLE I.

The following Table shows the number of pullets competing, the number of eggs laid, cost of food, return for eggs and gross profit for each of the thirty tests held since 1912/13 :—

Forty-eight weeks ended	No. of Pullets	No. of Eggs Laid	Average Number per Bird	Average Value per Bird		Cost of Food per Bird		Average Price of Eggs per doz.	Return per Bird over Cost of Food	
				s.	d.	s.	d.	d.	s.	d.
31st Aug., 1913	318	38,199	120.1	11	2.8	5	8	13.1	5	6.8
,, 1914	282	39,216	139.0	13	3.6	5	8.3	13.8	7	7.3
,, 1915	264	39,764	150.6	17	6	7	0.5	16.8	10	5.5
,, 1916	294	49,830	169.5	23	0.5	8	11.8	19.6	14	0.7
,, 1917	210	36,660	174.6	32	7.2	13	10.7	26.9	18	8.5
,, 1918	210	36,106	171.9	47	4	16	6	39.7	30	10.1
,, 1919	306	55,124	180.0	53	3.4	20	0	42.6	33	3.4
,, 1920	354	65,840	186.0	53	9	19	3.9	41.6	34	5.2
,, 1921	288	51,584	179.0	40	9.5	18	7.3	32.8	22	2.2
9th Sept., 1922	342	63,518	185.7	33	8.8	11	10	26.2	21	10.8
16th ,, 1923	198	38,519	194.5	27	11.5	12	1	20.8	15	10.5
15th ,, 1924	342	61,144	178.8	26	6.5	11	1.5	21.4	15	5.0
15th ,, 1925	348	63,755	183.2	27	4.9	10	5.2	22.6	16	11.7
15th ,, 1926	342	65,137	190.4	28	6.1	10	7.8	21.5	17	10.8
16th ,, 1927	492	93,912	190.9	26	10.7	9	3.6	20.3	17	7.1
16th ,, 1928	510	95,226	186.7	24	10.9	10	8	19.2	14	2.9
16th ,, 1929	540	101,820	188.6	28	8.5	11	0.5	21.9	17	8.0
16th ,, 1930	588	100,752	171.3	24	4.2	8	5.8	20.5	15	10.4
16th ,, 1931	588	111,180	189.1	24	4	7	3	18.5	17	1.0
15th ,, 1932	600	111,986	186.6	21	3.6	6	4.2	16.4	14	11.4
12th ,, 1933	606	113,047	186.5	17	11.6	5	1.8	13.9	12	9.8
10th ,, 1934	606	112,177	185.1	19	5	5	8.9	15.1	13	8.1
7th ,, 1935	702	131,384	187.1	18	3	6	7.7	14.0	11	7.3
3rd ,, 1936	702	130,940	186.5	20	7.5	7	3.2	15.9	13	4.3
Forty-six weeks ended										
18th Aug 1937	708	125,621	177.4	20	10.5	7	7.2	16.9	13	3.3
18th ,, 1938	678	126,143	186.1	21	9.9	8	4.6	16.9	13	5.3
18th ,, 1939	708	133,306	188.3	23	0.6	8	8.6	17.6	14	3.8
17th ,, 1940	672	121,250	180.4	27	6.8	10	10.4	22.0	16	8.4
18th ,, 1941	642	114,617	178.5	36	1.9	13	8.1	29.2	22	5.8
18th ,, 1942	438	77,640	177.3	41	0.5	17	7.7	33.3	23	4.8

It should be noted that the figures given in Table I above are based on the total number of pullets competing, no allowance having been made in respect of deaths.

Taking the birds which died during the 1941-42 test into account only up to the date of death, the average number of pullets for the whole period was 419.0 and the average number of eggs per bird 185.3. On this basis the average egg value per bird was 42s. 10.8d., the cost of food per bird 18s. 5.3d., and the return per bird over cost of food 24s. 5.5d.

TABLE II.

Average Egg Yield for each Breed.

Breed	No. of Pullets for full period	No. of eggs laid	Average No. of eggs per pullet	Grade Averages per Pullet		
				Special	First	Second
White Wyandotte	131	25,243	192.7	83.5	89.5	19.7
Rhode Island Red	183	34,057	186.1	80.5	89.1	16.5
White Leghorn	43	8,162	189.8	59.0	94.9	35.9
Light Sussex	28	5,309	189.6	56.8	101.5	31.3
Barred Rock	6	1,109	184.8	61.3	105.5	18.0
Buff Rock	6	1,007	167.8	148.5	19.3	—
All Breeds	397	74,887	188.6	78.2	89.9	20.5

TABLE III.

Average Egg Yield per Pullet during each of the Twelve Periods.

BREED	Number of Pullets for full period	Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan.20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Average for full period
White Wyandotte	131	12.2	14.9	16.7	16.1	17.9	19.2	20.8	19.6	18.0	15.4	14.6	7.3	192.7
Rhode Island Red	183	8.9	11.2	12.1	12.3	17.6	20.9	22.5	21.7	19.0	17.2	15.2	7.5	186.1
White Leghorn	43	7.9	11.7	14.6	12.9	18.1	20.3	22.1	20.9	19.5	18.8	16.5	6.5	189.8
Light Sussex	28	12.5	13.1	15.5	16.7	19.6	21.0	20.9	18.7	17.2	15.0	13.2	6.2	189.6
Barred Rock	6	10.0	10.2	13.7	6.3	16.3	20.3	24.1	20.5	22.3	18.7	15.2	8.2	184.8
Buff Rock	6	—	8.7	14.7	13.3	18.8	19.0	20.5	20.3	17.2	12 3	15.8	7.2	167.8
All Breeds ..	397	10.0	12.6	14.2	13.9	17.9	20.2	21.8	20.6	18.6	16.6	15.0	7.2	188.6

TABLE IV.

Average Weight of Egg for each Breed.

BREED	Total Number of Eggs Laid	Total Weight of Eggs	Average Weight of Egg	Average Weight Per Dozen
		lb. oz. dr.	*oz. dr.*	*oz.*
White Wyandotte	26,446	3,587 7 11	2 3	26.0
Rhode Island Red . .	35,131	4,796 9 15	2 3	26.2
White Leghorn ..	8,529	1,131 13 0	2 2	25.5
Light Sussex ...	5,418	718 5 0	2 2	25.5
Barred Rock ..	1,109	148 11 11	2 2	25.7
Buff Rock ...	1,007	153 7 7	2 7	29.3
All Breeds	77,640	10,536 6 12	2 3	26.1

TABLE V.

Number and Percentage of Special, First, and Second Grade Eggs for each Breed in respect of Pullets which completed the full 46-week Period.

BREED	EGGS LAID			PERCENTAGE DISTRIBUTION		
	Special Grade	First Grade	Second Grade	Special Grade	First Grade	Second Grade
				%	%	%
White Wyandotte	10,940	11,722	2,581	43.4	46.4	10.2
Rhode Island Red	14,739	16,304	3,014	43.3	47.9	8.8
White Leghorn	2,538	4,079	1,545	31.1	50.0	18.9
Light Sussex	1,590	2,843	876	29.9	53.6	16.5
Barred Rock	368	633	108	33.2	57.1	9.7
Buff Rock	891	116	—	88.5	11.5	—
All Breeds	31,066	35,697	8,124	41.5	47.7	10.8

TABLE VI.

Average Number of First Grade Eggs per Pullet during the period 1st October to 29th December, inclusive (90 days).

BREED	Number of Pullets	Number of First Grade Eggs	Average Number of First Grade Eggs per Pullet
White Wyandotte	146	5,313	36.4
Rhode Island Red	193	5,793	30.0
White Leghorn	47	1,283	27.3
Light Sussex	29	1,023	35.3
Barred Rock	6	162	27.0
Buff Rock	6	152	25.3
All Breeds	427	13,726	32.1

TABLE VII.

Eggs under the prescribed weight for Second Grade.

BREED	Number of Pullets for full period which laid ungraded eggs	Number of ungraded eggs
White Wyandotte	30	79
Rhode Island Red	34	66
White Leghorn	16	33
Light Sussex	13	19
Barred Rock	1	1
Buff Rock	1	1
All Breeds	95	199

TABLE VIII.

Number and Percentage of Pullets of each Breed which laid 200 First Grade Eggs and over, and not more than twenty per cent. Second Grade.

BREED	Number of Pullets for full Period	Number of Pullets which laid 200 First Grade Eggs and over	Percentage of Pullets which laid 200 First Grade Eggs and over
			%
White Wyandotte	131	40	30.5
Rhode Island Red	183	47	25.7
White Leghorn	43	7	16.3
Light Sussex	28	4	14.3
Barred Rock	6	—	—
Buff Rock	6	—	—
All Breeds	397	98	24.7

SECTION PRIZES.

Section I.—White Wyandotte.

NAME AND ADDRESS OF OWNER	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
	£ s. d.			
First Prize (£10) Sister-in-Charge, St. Martha's College, Navan, Co. Meath.	15 8 3½	1,289	45	214.8

Section II.—White Wyandotte (Station Holders).

NAME AND ADDRESS OF OWNER	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
	£ s. d.			
First Prize (£10). Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan.	17 8 5¾	1,479	24	246.5
Second Prize (£7). Mrs. W. Coleman, Banada, Ballaghaderreen, Co. Roscommon.	14 17 8½	1,282	169	213.7
Third Prize (£5). Mrs. C. Towey, Silverfield, Lisacul, Ballaghaderreen, Co. Roscommon.	14 13 2	1,246	227	207.7
Fourth Prize (£4). Miss A. Hanly, Cappa House, Cahir. Co, Tipperary.	14 12 10	1,260	73	210.0

Section III.—Rhode Island Red.

NAME AND ADDRESS OF OWNER	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
	£ s. d.			
First Prize (£10). Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.	15 6 9¼	1,331	9	221.8
Second Prize (£7). Mrs. K. Cuddihy, Hillside P.F., Glenmore, Co. Kilkenny.	14 12 7¾	1,254	136	209.0
Third Prize (£5). Mrs. M. A. Miller, Millview, Rathowen, (Co. Longford).	13 15 4½	1,184	94	197.3
Fourth Prize (£4). Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.	13 8 10	1,167	154	194.5

Section IV.—Rhode Island Red (Station Holders).

NAME AND ADDRESS OF OWNER	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
	£ s. d.			
First Prize (£10). Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.	15 9 6½	1,329	23	221.5
Second Prize (£7). Mrs. H. Langrell, Killinure, Tullow, (Co. Wicklow).	15 6 10½	1,306	9	217.7
Third Prize (£5). Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	13 12 3¼	1,190	133	198.3
Fourth Prize (£4). B. Bean Mhic Dhomhnaill, Imeall Atha, Baile an Fheirterigh, Daingean Uí Cúise, Co. Chiarraidhe.	13 2 4½	1,133	64	188.8

SECTION V.—ANY NON-SITTING BREED.

NAME AND ADDRESS OF OWNER.	Breed	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
		£ s. d.			
First Prize (£10). Sister-in-Charge, R.D.E. School, Swinford, Co. Mayo.	White Leghorn	14 2 0½	1,198	73	199.7
Second Prize (£7). Miss M. Rafferty, Leitrim, Four-Mile House, Roscommon.	do.	13 11 6¼	1,174	206	195.7

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED.

NAME AND ADDRESS OF OWNER.	Breed	Value of Eggs	Total No. of Eggs Laid	No. of Second Grade Eggs	Average No. of Eggs per Bird
		£ s. d.			
First Prize (£10). Sister-in-Charge, St. Mary's Abbey, Glencairn, Co. Waterford.	Light Sussex	14 8 1¾	1,230	132	205.0

SPECIAL PRIZES.

The Special Prize of a Silver Cup (or its value £10) for the *Pen* of pullets laying eggs of the highest market value during the Test has been awarded to Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan, for Pen No. 15 (White Wyandotte) which laid 1,479 eggs, value £17 8s. 5¾d., and which also won first prize in Section II.

The Special Prize of a Silver Medal (or £2) for the *Pen* of Pullets of non-sitting breed laying the highest number of first grade eggs during the period from 1st October to 29th December, inclusive, has been awarded to the Sister-in-Charge, R.D.E. School, Swinford, Co. Mayo, for Pen No. 88 (White Leghorn) which laid 234 first grade eggs during this period.

The following two pens tied for the Special Prize of a Silver Medal (or £2) for the *Pen* of pullets of sitting breed laying the highest number of first grade eggs during the period from 1st October to 29th December, inclusive, with a score of 351 first grade eggs during this period :—

Pen No. 2 (White Wyandotte) owned by the Sister-in-Charge, St. Martha's College, Navan, Co. Meath.

Pen No. 62 (Rhode Island Red) owned by Mrs. H. Langrell, Killinure, Tullow, (Co. Wicklow).

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of non-sitting breed laying the highest number of first grade eggs during the Test has been awarded to Miss M. Rafferty, Leitrim, Four-Mile-House, Roscommon, for Pullet No. 361 (Pen No. 90, White Leghorn) which laid 237 first grade eggs.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of sitting breed laying the highest number of first grade eggs during the Test has been awarded to Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan, for Pullet No. 79 (Pen No. 15, White Wyandotte) which laid 270 first grade eggs.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of non-sitting breed laying the highest number of first grade eggs during the period 1st October to 29th December, inclusive, has been awarded to Miss M. Rafferty, Leitrim, Four-Mile-House, Roscommon, for Pullet No. 365 (Pen No. 90, White Leghorn) which laid 60 first grade eggs during this period.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of sitting breed laying the highest number of first grade eggs during the period 1st October to 29th December, inclusive, has been awarded to Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan, for Pullet No. 79 (Pen No. 15, White Wyandotte) which laid 74 first grade eggs during this period.

COPPER RINGS AND SPECIAL CERTIFICATES OF MERIT.

Particulars of 70 pullets which laid 200 first grade eggs or over, and which were awarded Copper Rings and Special Certificates.

TABLE IX.

WHITE WYANDOTTE (25 PULLETS).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner.
			Special Grade	First Grade	Second Grade	Total	
1	3 5	2379 2380	196 158	18 52	— 1	214 211	Mr. W. Barron, "Wood View," Gortrush, Piltown, Co. Kilkenny.
2	8 12	2381 2382	212 25	14 188	— 14	226 227	Sister-in-Charge, St. Martha's College, Navan, Co. Meath.
3	16	2383	227	6	—	233	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.
5	27 28	2384 2385	108 156	117 54	6 1	231 211	Mrs. M. Nagle, Springmount, Mallow, Co. Cork.
6	446 449 450	2386 2387 2388	133 31 45	94 178 155	— 16 2	227 225 202	Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.
7	38 39 41	2389 2390 2391	222 38 175	18 163 54	— 30 5	240 231 234	Mrs. L. O'Reilly, Rodstown, Balrath, Ceanannus Mor, Co. Meath.
8	43 45 47 48	2392 2393 2394 2395	110 33 92 93	108 178 138 131	4 11 — 1	222 222 230 225	Mr. W. Barron, "Wood View," Gortrush, Piltown, Co. Kilkenny.
9	52	2396	144	58	3	205	Mrs. K. O'Driscoll, Lisloose, Tralee, Co. Kerry.
12	72	2397	107	135	2	244	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.
15	79	2398	214	56	—	270	Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan.
16	87 89	2399 2400	9 109	193 117	32 13	234 239	Miss A. Hanly, Cappa House, Cahir, Co. Tipperary.
19	101	2401	105	126	1	232	Mrs. M. Connolly, Carrigamore, Corvalley P.O., Co. Monaghan.

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner.
			Special Grade	First Grade	Second Grade	Total	
24	127	2402	46	156	12	214	Mrs. W. Coleman, Banada, Ballaghaderreen, Co. Roscommon.
28	35	2403	44	175	10	229	Mrs. M. Gammons, Ladyrath, Wilkinstown, Navan, Co. Meath.

Rhode Island Red (36 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner.
			Special Grade	First Grade	Second Grade	Total	
30	157	2404	155	80	2	237	Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.
31	165	2405	198	2	1	201	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.
32	171	2406	173	36	—	209	Miss V. Smith, Bridge House, Bettystown, Co. Meath
33	175	2407	91	110	1	202	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.
36	182	2408	116	101	3	220	Mrs. M. A. Miller, Millview, Rathowen, (Co. Longford).
39	196	2409	9	210	25	244	Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.
45	224	2410	133	89	3	225	Mrs. K. Cuddihy, Hillside P.F., Glenmore, Co. Kilkenny.
46	229 230 232 233 234	2411 2412 2413 2414 2415	76 34 119 112 132	154 188 95 121 102	1 4 2 — 1	231 226 216 233 235	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	First Grade	Second Grade	Total	Name and Address of Owner.
48	147	2416	90	130	9	229	Mrs. K. Earl, Grantstown House, Waterford.
	149	2417	172	67	2	241	
51	254	2418	200	24	6	230	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.
	257	2419	148	52	5	205	
	258	2420	16	205	51	272	
54	271	2421	9	193	10	212	Mrs. M Kelleher, Kileedy, Ballagh. Charleville, Co. Cork.
55	278	2422	110	97	4	211	Miss C. Mealiff, Ballinamona, House Tullamore, Offaly.
56	285	2423	72	144	3	219	Mrs. M. J. Walker, Lower Woodhead, Ballyloughan, Bruckless, Co. Donegal.
60	301	2424	151	60	—	211	Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.
	303	2425	51	180	14	245	
	304	2426	195	41	2	238	
	305	2427	148	62	—	210	
	306	2428	47	186	7	240	
61	307	2429	33	196	16	245	Mrs. L. Hayes, Walshestown, Castlemahon, Newcastle West, Co. Limerick.
	308	2430	209	28	2	239	
	310	2431	65	151	8	224	
62	313	2432	59	165	—	224	Mrs. H. Langrell, Killinure, Tullow, (Co. Wicklow).
	315	2433	217	18	—	235	
	316	2434	72	152	4	228	
63	322	2435	10	198	21	229	Mrs. T. Godwin, Belmont, Milltown, Co. Galway.
64	326	2436	89	130	6	225	Mrs. M. O'Reilly, St. Johnsfort, Ardee, (Co. Meath).
	328	2437	62	191	4	257	
65	428	2438	38	195	4	237	E. Bean Mhic Dhomhnaill, Baile an Fheirtegh, Daingean Uí Cuise, Co. Chiarraidhe.
	429	2439	155	101	—	256	

White Leghorn (7 Pullets)

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner
			Special Grade	First Grade	Second Grade	Total	
85	331	1805	61	141	3	205	Mrs. M. Hanly, Cooga, Doon, Co. Limerick.
88	350 353 354	1806 1807 1808	157 149 163	64 71 54	3 3 1	224 223 218	Sister-in-Charge, R.D.E. School, Swinford, Co. Mayo.
90	361 364 365	1809 1810 1811	88 120 21	149 99 209	2 1 13	239 220 243	Miss M. Rafferty, Leitrim, Four-mile House, Roscommon.

Light Sussex (2 Pullets).

Pen Number	Pullet Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner.
			Special Grade	First Grade	Second Grade	Total	
73	380 382	2440 2441	170 62	71 175	— 14	241 251	Sister-in-Charge, St. Martha's College, Navan, Co. Meath.

CERTIFICATES OF MERIT.

Particulars of pullets which laid 200 first grade eggs and over, and which were awarded Special Certificates are shown in Table X.

Pullets which laid 170 but less than 200 first grade eggs and which were awarded Certificates are shown in the following table.

TABLE X.

WHITE WYANDOTTE

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.	3	13 18	175 181	4 —	179 181
Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.	6	445	195	10	205
Mrs. E. M. J. Condron, Knocktemple, Virginia, Co. Cavan.	10	59	184	35	219
Mrs. K. F. Graham. Ballagh Lodge. Donadea, Co. Kildare.	12	68	198	—	198
Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan.	15	84	192	14	206
Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.	18	94	177	3	180
Mrs. M. Connolly, Carrigamore, Corvalley P.O., Co. Monaghan.	19	100	178	4	182
Mrs. T. Kelly, Ballyskea, Monivea, Co. Galway.	20	104	176	8	184
Mrs. C. Towey, Silverfield, Lisacul, Ballaghaderreen, Co. Roscommon.	22	115 116 117 119 120	177 174 191 175 178	37 19 3 31 34	214 193 194 206 212
Mrs. W. Coleman, Banada, Ballaghaderreen, Co. Roscommon.	24	130	191	1	192
Mrs. M. Gammons, Ladyrath, Wilkinstown, Navan, Co. Meath.	28	36	190	—	190

Rhode Island Red.

Name and Address of Owner.	Pen No.	Pullet No.	Eggs Laid First Grade	Eggs Laid Second Grade	Total
Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.	29	152 153 155	172 171 182	6 20 12	178 191 194
Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.	31	164	199	13	212
Miss V. Smith, Bridge House, Bettystown, Co. Meath.	32	170	195	—	195
Mrs. M. A. Miller, Millview, Rathowen, (Co. Longford).	36	181 183 184	185 196 178	3 1 22	188 197 200
Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.	39	193	170	1	171
Miss M. Keane, Killurin, Co. Wexford.	40	200	176	1	177
Mrs. K. Cuddihy, Hillside P.F., Glenmore, Co. Kilkenny.	41	205 208	178 199	6 18	184 217
Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.	46	231	189	1	190
Sister-in-Charge, St. Martha's College, Navan, Co. Meath.	47	437	182	7	189
Mrs. K. Earl, Grantstown House, Waterford.	48	145	182	10	192
Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.	49	241	180	5	185
Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.	50	248 249 250 251 252	172 195 177 190 197	2 — 14 3 —	174 195 191 193 197
Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.	53	266 269	172 199	— —	172 199
Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.	55	282	179	40	219
Mrs. K. Kilduff, Knockdrin, Mullingar, Co. Westmeath.	57	289	176	—	176
Mrs. E. Hammersley, Ashvale, Lattin, Tipperary.	58	298	179	4	183

Name and Address of Owner.	Pen No.	Pullet No.	Eggs Laid.		
			First Grade	Second Grade	Total
Mrs. L. Hayes, Walshestown, Castlemahon, Newcastle West, Co. Limerick.	61	312	184	—	184
Mrs. H. Langrell, Killinure, Tullow, (Co. Wicklow).	62	314 317	178 190	— 5	178 195
Mrs. M. O'Reilly, St. Johnsfort,Ardee, (Co. Meath).	64	327	170	31	201
E. Bean Mhic Dhomhnaill, Imeall Atha, Baile an Fheirteigh, Daingean Ui Cúise, Co. Chiarraidhe.	65	427 432	171 177	11 —	182 177

White Leghorn.

Name and Address of Owner.	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. W. Byrne, Kilcar, Curraghboy, Athlone, Co. Roscommon.	86	338	198	2	200
Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.	87	344 347 348	186 185 183	10 — 6	196 185 189
Miss M. Rafferty, Leitrim, Four-Mile-House, Roscommon.	90	366	193	5	198
Mrs. M. O'Shea, Farrantane, Castlegregory, Co Kerry.	95	375	195	4	199

Light Sussex.

Name and Address of Owner.	Pen No.	Pullet No.	Eggs Laid.		
			First Grade	Second Grade	Total
Mrs. N. O'Sullivan, Hill View, Bandon, Co. Cork.	70	401	178	—	178
Miss M. Daly, Knockglass, Moynalty, Ceanannus Mor, Co. Meath	71	406	181	42	223
Sister-in-Charge, St. Martha's College, Navan, Co. Meath.	73	384	174	8	182

Barred Rock

Name and Address of Owner	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. E. A. Henderson, Ardrum, Inniscarra. Co. Cork.	75	423	196	35	231
		425	184	1	185
		426	171	26	197

Buff Rock.

Name and Address of Owner.	Pen No.	Pullet No.	Eggs Laid		
			First Grade	Second Grade	Total
Mrs. A. Coleman, Ballycullen House, Croom, Co. Limerick.	76	417	181	—	181
		418	185	—	185

TABLE XI.

Number and percentage of Pullets of each Breed which qualified for Certificates of Merit.

BREED	Number of Pullets for full Period	Number of Certificates Awarded	Percentage of Pullets awarded Certificates	Percentage Distribution Special Certificates	Percentage Distribution Certificates
			%	%	%
White Wyandotte	131	41	31.3	19.1	12.2
Rhode Island Red	183	68	37.2	19.7	17.5
White Leghorn	43	13	30.2	16.3	13.9
Light Sussex	28	5	17.9	7.2	10.7
Barred Rock	6	3	50.0	—	50.0
Buff Rock	6	2	33.3	—	33.3
All Breeds	397	132	33.2	17.6	15.6

TABLE XII.

Results of post-mortem examinations performed by the Veterinary College.

Date of Death	Number of Pullet	Number of Pen	BREED	Result of Post-mortem Examination.
1941				
Oct. 31	51	9	White Wyandotte	Visceral gout.
Nov. 26	144	27	White Wyandotte	Enteritis.
Dec. 1	299	58	Rhode Island Red	Leukaemia.
,, 5	133	25	White Wyandotte	Neuro-lymphomatosis.
,, 6	391	69	Light Sussex	Impaction of the crop.
,, 6	209	41	Rhode Island Red	Visceral gout.
,, 15	142	27	White Wyandotte	Tapeworm infestation.
,, 15	256	51	Rhode Island Red	Visceral gout.
,, 15	363	90	White Leghorn	Roundworm and threadworm infestation.
,, 16	309	61	Rhode Island Red	Visceral gout.
,, 17	176	33	Rhode Island Red	Visceral gout and worm infestation.
1942				
Jan. 1	106	20	White Wyandotte	Rupture of a fatty liver.
,, 22	198	39	Rhode Island Red	Peritonitis.
,, 28	70	12	White Wyandotte	Rupture of a fatty liver.
Feb. 4	75	14	White Wyandotte	Oopheritis and tapeworm infestation.
,, 19	143	27	White Wyandotte	Enteritis.
,, 23	369	91	White Leghorn	Oviductitis and peritonitis.
Mar. 2	53	9	White Wyandotte	Nephritis.
,, 23	332	85	White Leghorn	Lymphomatosis of the viscera.
,, 28	434	47	Rhode Island Red	Rupture of a fatty liver.
April 7	1	1	White Wyandotte	Peritonitis.
,, 13	91	18	White Wyandotte	Neuro-lymphomatosis.
,, 14	180	33	Rhode Island Red	Peritonitis.
,, 21	63	11	White Wyandotte	Opthalmic haemorrhages.
,, 22	215	43	Rhode Island Red	Rupture of blood tumours.
,, 23	381	73	Light Sussex	Visceral gout.
May 4	345	87	White Leghorn	Peritonitis.
,, 15	93	18	White Wyandotte	Neuro-lymphomatosis.
,, 26	71	12	White Wyandotte	Peritonitis.
,, 29	95	18	White Wyandotte	Nephritis.
June 4	290	57	Rhode Island Red	Enteritis and nephritis.
,, 5	292	57	Rhode Island Red	Enteritis.
,, 15	138	25	White Wyandotte	Leukaemia.
,, 16	92	18	White Wyandotte	Neuro-lymphomatosis.
,, 23	438	47	Rhode Island Red	Peritonitis and oviductitis.
,, 26	351	88	White Leghorn	Peritonitis.
,, 29	293	57	Rhode Island Red	Worm infestation.
July 7	239	68	Rhode Island Red	Tumours (Sarcoma).
,, 21	14	3	White Wyandotte	Peritonitis.
,, 30	436	47	Rhode Island Red	Peritonitis.
Aug. 17	134	25	White Wyandotte	Gout.

TABLE XIII.

Number and Percentage of Deaths for each Breed.

BREED	Number of Pullets Penned	Number of Deaths	Percentage of Deaths
			%
White Wyandotte	150	19	12.7
Rhode Island Red	198	15	7.6
White Leghorn	48	5	10.4
Light Sussex	30	2	6.7
Barred Rock	6	—	—
Buff Rock	6	—	—
All Breeds	438	41	9.4

SECTION I.—WHITE WYANDOTTE.—6 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of Test lb. oz.	Eggs Laid Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1—Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
1	2	Sister-in-Charge, St. Martha's College Sion, Navan, Co. Meath.	1941 Feb 21	7	5 6	7 8	19	22	22	19	20	19	16	13	13	10	8	3	175	8	1	184	66	45 4¾	2 0	(a) 1,289	—	—	July, *June*.
			Feb 14	8	5 3	6 14	20	18	16	18	20	23	20	24	25	15	16	11	212	14	—	226	58	53 6	2 0	lb. oz. dr	—	—	*Apl*, *Aug*.
			"	9	4 14	5 8	25	19	20	18	18	20	20	15	22	23	19	9	186	41	1	228	67	54 6	2 4	(b) 181 2 2	1	—	*July*.
				10	5 15	6 0	18	15	22	18	22	23	23	25	26	18	21	—	207	23	1	231	58	54 6½	2 6	(c) 27 0 oz.	—	—	*Aug*.
			Feb "21	11	5 0	6 4	18	17	20	18	18	17	20	20	15	13	14	3	12	153	28	193	43	45 11¼	2 1	(d) £15 8 3½	—	—	*Aug*.
			"	12	4 10	6 0	19	23	24	22	20	17	23	18	21	18	13	9	25	188	14	227	59	54 5	2 1		—	—	Aug.
2	6	Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.	Feb. 13	445	6 10	7 4	16	19	18	12	18	16	18	22	22	19	17	8	107	88	10	205	46	48 0	2 3	(a) 1,157	—	—	—
			Feb. 21	446	6 14	7 8	14	20	19	19	18	22	20	22	23	21	21	8	133	94	—	227	57	53 7¾	2 4	lb. oz. dr.	—	—	—
			Mar. 17	447	5 9	6 5	9	15	8	—	—	18	20	24	24	10	13	13	21	116	17	154	29	33 5½	2 1	(b) 155 9 1	—	—	Dec.
			Mar. 9	448	6 1	6 9	—	—	3	22	22	19	25	15	18	7	13	—	15	126	3	144	8	33 2	2 2	(c) 25 8 oz	—	1	Oct., July.
			Mar. 17	449	5 10	7 6	20	21	20	7	21	21	25	19	24	18	18	11	31	178	16	225	51	52 8	2 2	(d) £13 8 5¼	—	—	Jan.
			Feb. 13	450	5 14	7 6	—	6	24	25	25	18	26	23	24	12	15	4	45	155	2	202	36	47 6½	2 2		—	—	Oct.
3	3	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.	Jan. 25	13	4 12	6 4	—	14	11	12	21	19	20	21	20	19	17	5	114	61	4	179	24	40 11¼	2 4	(a) 1,134	—	—	Oct.
			Jan. 16	14	4 14	D	19	10	—	14	21	22	19	21	18	4	D1	—	33	107	9	149	27	34 8½	2 2	lb. oz. dr.	1	—	Nov., June.
			"	15	4 13	6 4	22	22	19	17	17	19	21	10	11	12	20	10	48	145	7	200	64	48 10	2 2	(b) 160 7 2	—	—	Aug.
				16	5 0	6 10	20	21	22	22	21	21	22	22	20	23	12	7	227	6	—	233	68	55 9¼	2 7	(c) 27.2 oz.	—	—	Oct
			Feb. "22	17	4 12	6 6	—	13	20	19	21	21	19	21	18	16	16	8	167	23	2	192	35	45 2¼	2 6	(d) £13 6 7½	—	—	Oct.
			Jan. 16	18	5 4	7 0	19	14	11	—	9	21	19	22	21	16	17	12	83	98	—	181	44	41 1½	2 3		—	1	Dec., Aug.
4	4	Mrs. A. M. Murray, Tanderagee, Enfield, Co. Meath.	Feb.	19	7 2	9 0	22	21	24	21	26	13	23	21	17	14	2	—	202	1	1	204	70	49 8	2 7	(a) 1,117	—	—	July, *June*.
			"	20	5 12	8 2	—	10	7	—	8	26	28	28	23	23	10	9	166	6	—	172	17	37 3	2 6	lb. oz. dr.	—	—	Oct.
			"	21	6 2	7 8	4	24	13	9	25	23	25	27	25	24	22	12	61	162	10	233	41	53 0¼	2 2	(b) 156 15 8	—	—	*Oct*.
			Mar.	22	5 15	7 8	18	18	17	5	12	23	25	24	19	18	8	7	91	99	4	194	53	44 10	2 3	(c) 27.0 oz.	—	1	Jan., Aug.
			Feb.	23	6 8	7 10	—	—	—	—	11	10	18	21	17	19	8	11	103	12	—	115	—	24 3	2 5	(d) £12 15 1½	—	—	Oct., Aug.
			Mar.	24	5 11	9 8	—	6	19	21	19	22	21	23	18	20	18	12	7	177	15	199	21	46 1¼	2 1		—	—	*Oct*.
5	5	Mrs. M. Nagle, Springmount, Mallow, Co. Cork.	Mar. 3	25	5 7	7 0	4	19	19	3	4	20	22	24	19	18	20	7	35	124	20	179	32	40 3	2 2	(a) 997	—	—	Jan.
			"	26	5 0	6 12	10	17	15	11	15	17	20	17	16	17	15	8	84	85	9	178	40	41 6¾	2 3	lb. oz. dr.	1	—	—
			"	27	5 8	6 8	21	23	20	13	16	20	23	22	24	18	20	11	108	117	6	231	62	54 4¾	2 3	(b) 136 4 10	—	—	Jan. *Aug*.
			"	28	5 3	7 0	14	21	19	11	7	19	23	24	23	22	21	7	156	54	1	211	56	48 9½	2 4	(c) 26.2 oz.	—	—	Jan
			"	29	5 12	8 12	—	—	—	13	28	3	20	16	10	15	16	3	54	62	8	124	—	28 3¼	2 3	(d) £11 11 5¾	—	4	Oct., July.
			"	30	5 8	8 8	13	13	9	4	7	9	9	7	3	—	—	—	41	25	8	74	28	18 2½	2 3		—	—	May, *May*.

SECTION I—WHITE WYANDOTTE (continued).

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen (b) Total weight. (c) Av. Wt. per dozen (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
†	1	Mr. W. Barron,	1941 Jan. 28	1	5 10	D	20	22	18	20	18	11	D2	—	—	—	—	—	14	94	3	111	64	30 3	2 2	(a) 922	—	—	—
		"Wood View,"	,,	2	5 2	6 4	—	11	21	18	17	19	21	24	4	—	—	—	22	110	3	135	36	32 6¾	2 2	lb. oz. dr.	—	—	Oct., *May*.
		Gortrush,	,,	3	6 10	5 4	20	25	21	20	7	12	22	20	23	19	18	7	196	18	—	214	69	50 8½	2 6	(b) 120 3 2	—	—	Feb.
		Piltown,	,,	4	6 10	9 4	10	10	8	11	5	11	16	18	10	6	8	—	90	23	—	113	31	26 4¼	2 5	(c) 26.9 oz.	—	—	Jan., *July*.
		Co. Kilkenny.	,,	5	5 1	5 12	20	13	17	6	18	21	24	20	23	21	18	10	158	52	1	211	52	48 10¾	2 4	(d) £11 0 3	—	—	Jan, Aug, *July*.
			,,	6	5 4	4 10	—	6	9	10	16	19	17	17	16	16	12	—	33	99	6	138	18	31 5¾	2 2		—	—	Oct., Aug.

†Disqualified under Clause 26 (pen produced less than 960 eggs). D = Dead.

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—19 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet	Average Weight of Eggs per Pullet	(a) Total Eggs from Pen (b) Total weight. (c) Av. Wt. per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
			1941																					s. d.	oz. dr.				
1	15	Mrs. E. Hillis,	Feb. 2	79	4 13	5 14	22	23	25	23	25	25	23	27	24	21	21	8	214	56	—	270	74	64 6½	2 4	(a) 1,479	—	—	—
		Corrush,	,,	80	5 5	5 8	16	7	7	21	23	22	25	27	25	22	20	11	218	8	—	226	34	52 2¼	2 6	lb. oz. dr.	—	—	*July.*
		Doohamlet,	,,	81	5 10	6 10	23	22	23	21	22	21	23	25	20	20	21	8	232	11	3	249	72	59 5½	2 5	(b) 208 4 11	—	—	*July.*
		Castleblayney,	,,	82	5 4	6 12	23	20	21	23	23	21	24	22	23	19	17	6	213	27	2	242	67	57 10	2 4	(c) 27.0 oz	—	—	*July.*
		Co. Monaghan.	,,	83	5 0	6 3	14	26	24	27	27	27	26	25	27	27	25	11	127	154	5	286	68	67 10¾	2 3	(d) £17 8 5¾	—	—	—
			,,	84	5 3	5 8	14	18	8	—	23	22	23	26	24	19	19	10	48	144	14	206	29	46 6¼	2 2		—	—	Dec, *July.*
																								s. d.	oz. dr.				
*	7	Mrs. L. O'Reilly,	Mar. 3	37	5 4	6 0	20	19	18	19	18	20	22	10	22	8	13	10	7	150	42	199	28	47 2	2 1	(a) 1,284	—	2	May.
		Rodstown,	,,	38	5 4	6 6	22	21	21	20	20	19	23	23	20	21	22	8	222	18	—	240	69	57 2¼	2 6	lb oz. dr.	—	—	*July.*
		Balrath,	,,	39	4 12	6 2	26	23	22	21	20	19	18	23	24	21	14	—	38	163	30	231	49	54 10¾	2 1	(b) 170 3 8	—	—	*July.*
		Ceanannus Mor,	,,	40	5 0	6 0	18	23	22	21	20	22	23	22	21	13	17	9	2	35	191	231	3	50 11¾	1 14	(c) 25 5 oz.	5	—	*July.*
		Co. Meath.	,,	41	5 0	5 14	19	20	21	21	19	23	24	17	23	19	18	10	175	54	5	234	59	55 9	2 4	(d) £14 18 11	1	—	*July.*
			,,	42	5 4	6 4	20	6	—	5	16	14	22	22	19	1	14	10	11	100	38	149	14	32 11½	2 0		2	—	Nov, July.
																								s. d.	oz. dr.				
2	24	Mrs. W. Coleman,	Mar. 30	127	4 8	6 12	—	20	22	20	22	20	24	23	22	16	19	6	46	156	12	214	36	50 1¼	2 2	(a) 1,282	—	—	Oct.
		Banada,	,,	128	4 8	6 0	4	20	21	17	22	20	20	19	13	20	16	2	164	29	1	194	46	46 3¼	2 6	lb. oz. dr.	—	1	Oct. July.
		Ballaghaderreen,	,,	129	4 12	6 0	20	17	22	21	22	23	22	25	24	23	23	10	3	149	100	252	12	57 2¼	2 0	(b) 171 9 10	3	—	—
		Co. Roscommon.	,,	130	4 8	7 4	—	—	14	22	23	21	24	21	22	17	19	9	157	34	1	192	19	44 4¼	2 5	(c) 25.7 oz.	—	—	Oct.
			,,	131	4 8	6 2	14	21	21	22	19	22	25	27	23	18	22	10	3	188	53	244	19	56 5½	2 0	(d) £14 17 8½	6	—	—
			,,	132	4 9	7 4	5	18	17	13	14	14	20	19	21	19	17	9	34	150	2	186	41	43 3¾	2 2		—	—	Oct
																								s. d.	oz. dr.				
3	22	Mrs. C. Towey,	Mar. 21	115	5 2	6 8	16	22	17	17	22	18	21	19	19	20	17	6	26	151	37	214	25	50 2	2 1	(a) 1,246	—	—	—
		Silverfield,	,,	116	4 13	5 14	19	20	16	19	18	18	18	18	16	16	11	4	83	91	19	193	41	46 0½	2 3	lb. oz. dr.	—	—	*July.*
		Lisacul,	,,	117	5 8	6 15	—	9	23	21	21	21	22	19	18	17	16	7	110	81	3	194	35	45 8¾	2 4	(b) 162 13 13	—	—	Oct.,June,*July.*
		Ballaghaderreen,	,,	118	4 12	5 10	12	21	25	22	22	22	23	22	14	21	11	12	2	122	103	227	3	52 3	1 15	(c) 25.1 oz.	12	—	*July.*
		Co. Roscommon	,,	119	5 11	7 0	13	18	16	18	18	18	19	19	20	18	19	10	24	151	31	206	25	48 0¾	2 1	(d) £14 13 2	3	—	June
			,,	120	5 1	6 6	20	20	22	20	22	20	21	20	16	—	21	10	49	129	34	212	32	50 11	2 2		2	1	July
																								s. d.	oz. dr.				
4	16	Miss A. Hanly,	Feb. 2	85	4 12	7 2	5	20	17	16	19	17	22	9	20	11	14	12	3	157	22	182	44	42 9½	2 0	(a) 1,260	—	2	Oct, May, *June.*
		Cappa House,	,,	86	5 8	5 12	18	14	18	19	18	22	24	22	20	20	—	5	99	96	5	200	50	47 2¾	2 3	lb. oz. dr.	—	—	Aug.
		Cahir,	,,	87	5 8	7 8	—	19	—	18	27	25	28	24	24	28	27	14	9	193	31	234	14	52 6¼	2 1	(b) 173 6 5	1	—	Oct.
		Co. Tipperary.	,,	88	5 8	7 3	—	2	22	22	24	26	23	21	26	23	22	11	209	13	—	222	30	51 7¼	2 6	(c) 26.4 oz.	—	—	Oct., *July*
			Feb. 12	89	4 14	6 10	16	22	13	17	22	23	25	22	23	22	23	11	109	117	13	239	42	55 10¾	2 3	(d) £14 12 10	—	—	Oct, *July.*
			,,	90	4 14	7 4	—	13	16	19	16	18	19	21	18	16	17	10	169	13	1	183	32	42 9¼	2 7		—	—	Oct.

*Disqualified under Clause 26 (more than 20 per cent. second grade eggs).

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of Test lb. oz.	Eggs Laid Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
5	8	Mr. W. Barron, "Wood View," Gortrush, Piltown, Co. Kilkenny.	1941 Jan. 28	43	6 0	6 6	—	11	23	20	22	23	22	25	24	21	22	9	110	108	4	222	36	51 8¼	2 3	(a) 1,231	—	—	Oct., *July.*
			,,	44	6 7	7 12	16	—	18	13	24	15	23	11	26	12	12	10	9	158	13	180	35	42 2¼	2 1	lb. oz. dr.	2	5	Nov., July.
			,,	45	5 14	8 6	1	28	15	24	25	23	23	23	15	13	16	14	33	178	11	222	45	52 8¼	2 2	(b) 166 9 7	1	2	*Dec., July.*
			,,	46	5 14	7 4	9	20	17	20	17	21	11	23	2	12	—	—	98	53	1	152	49	37 5¼	2 4	(c) 26.0 oz.	—	2	Apl.
			,,	47	5 6	6 14	17	5	11	21	23	22	27	27	24	21	22	10	92	138	—	230	37	53 3¼	2 3	(d) £14 11 8¾	1	—	Nov.
			,,	48	6 2	8 8	24	21	24	22	16	18	23	19	17	17	16	8	93	131	1	225	73	54 4½	2 3		1	—	*May.*
6	23	Miss J. McDermott, Ballyhack, Ashbourne, Co. Meath.	Feb. 10	121	5 3	6 2	21	23	24	21	24	22	25	12	21	1	23	—	3	96	118	217	18	50 7¼	1 15	(a) 1,184	—	3	Aug.
			,,	122	5 0	6 8	23	24	22	22	25	23	25	20	9	8	14	12	106	117	4	227	71	55 5	2 3	lb. oz. dr.	1	—	May.
			,,	123	4 12	6 0	19	21	21	20	20	20	22	19	14	7	3	1	7	138	43	188	30	44 11¾	2 0	(b) 157 2 12	1	—	July.
			,,	124	5 9	7 4	12	19	21	19	21	19	20	19	22	15	15	5	99	99	9	207	54	49 1¼	2 3	(c) 25.5 oz.	—	—	—
			,,	125	5 1	5 8	20	19	13	—	—	22	25	16	13	—	—	5	3	98	32	133	42	30 2	2 0	(d) £13 19 10¼	—	3	Dec., July.
			,,	126	5 0	7 8	9	—	15	25	23	23	25	25	17	19	21	10	187	24	1	212	28	19 6½	2 5		—	—	Oct.
7	19	Mrs. M. Connolly, Carrigamore, Corvally P.O., Co. Monaghan.	Feb. 26	97	4 10	5 12	18	21	20	19	20	18	21	22	22	18	18	10	46	149	32	227	34	53 4¾	2 1	(a) 1,176	—	—	—
			,,	98	5 1	5 12	17	22	19	18	19	19	21	15	16	12	13	8	152	46	1	109	60	48 1¾	2 4	lb. oz. dr.	—	2	July.
			,,	99	5 3	6 12	18	23	23	9	—	6	23	22	10	18	15	11	136	42	—	178	69	41 9	2 4	(b) 163 6 9	—	1	Jan.
			,,	100	4 12	6 4	17	22	19	19	16	15	19	16	13	11	8	7	137	41	4	182	59	44 3¼	2 5	(c) 26.7 oz.	—	2	*July.*
			,,	101	4 8	6 4	13	20	21	18	19	22	19	24	21	23	23	9	105	126	1	232	58	54 10½	2 3	(d) £13 19 4½	—	—	Oct., *Aug.*
			,,	102	4 14	6 15	—	1	17	16	17	17	12	17	11	18	20	6	129	28	1	158	21	36 11	2 5		—	—	Oct.
[illegible]	10	Mrs. E. M. J. Condron, Knocktemple, Virginia, Co. Cavan.	Jan. 21	55	5 0	6 9	14	—	—	16	22	18	19	25	23	20	24	11	1	162	29	192	3	42 8¼	2 1	(a) 1,104	1	—	Oct.
			,,	56	5 9	6 5	12	—	14	12	17	21	15	15	15	13	14	7	27	109	19	155	17	35 10¼	2 2	lb. oz. dr.	—	3	Oct.
			,,	57	5 1	7 10	3	13	22	19	18	14	23	23	14	14	11	11	21	151	13	185	40	43 2¼	2 2	(b) 147 11 6	—	—	—
			,,	58	4 12	6 8	21	12	20	3	20	10	23	6	11	15	5	5	138	12	1	151	56	36 6¼	2 7	(c) 25.7 oz.	2	3	Jan., July.
			,,	59	4 13	5 14	17	16	21	26	23	23	15	19	19	15	13	12	36	148	35	219	50	52 3¼	2 1	(d) £12 18 3	—	2	July, *May*
			,,	60	4 13	6 6	20	12	21	22	11	22	19	16	21	21	13	4	26	152	24	202	38	47 7¼	2 2		3	1	Feb., *July*
[illegible]	29	Mrs. T. Kelly, Fallyskea, Monivea, Co. Galway.	Feb. 3	103	4 8	5 10	—	—	20	26	26	22	23	20	21	18	20	12	32	171	5	208	24	18 9	2 2	(a) 1,072	—	—	Oct.
			,,	104	4 8	6 7	—	8	24	22	18	21	22	23	11	12	15	8	52	124	8	184	37	43 5¼	2 3	lb. oz. dr.	—	2	Oct., Aug.
			,,	105	4 14	7 6	18	13	19	12	16	19	22	17	20	5	—	—	88	73	—	161	53	38 4	2 3	(b) 113 8 0	—	—	Jn
			,,	106	5 6	D	11	21	17	D	—	—	—	—	—	—	—	—	46	3	—	49	19	13 6	2 4	(c) 25.7 oz.	—	—	Oct.
			Mar. 1	107	4 14	5 8	26	25	23	22	24	23	25	26	25	22	21	12	10	238	26	274	58	64 9¼	2 1	(d) £12 13 9¼	—	—	*July.*
			,,	108	5 6	7 0	—	—	12	24	21	18	25	21	24	24	19	8	123	73	—	196	18	44 11¼	2 3		—	—	Oct.

D = Dead.

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz)	Weight: At close of Test (lb. oz)	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
	28	Mrs. M. Gammons,	1941 Mar. 9	31	4 8	7 3	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	3	1 12	(a) 1,006	—	—	May, *May*.
		Ladyrath,	"	32	4 9	6 2	20	16	24	24	23	21	22	22	22	17	18	8	4	63	170	237	5	53 1¾	1 15	lb. oz. dr.	5	—	—
		Wilkinstown,	"	33	4 11	6 0	7	15	14	15	15	17	18	20	15	13	10	—	2	100	57	159	3	36 3¼	2 0	(b) 134 8 11	1	1	*July*.
		Navan,	"	34	5 9	6 2	9	17	16	17	15	17	20	21	20	16	15	7	189	1	—	190	45	44 7½	2 7	(c) 25.7 oz.	—	—	July.
		Co. Meath.	"	35	5 0	6 4	14	19	19	21	21	20	21	25	20	18	21	10	14	175	10	229	47	54 1¼	2 2	(d) £11 13 3¼	—	—	—
			"	36	5 0	5 10	2	19	19	18	18	19	21	20	20	17	17	—	123	67	—	190	44	14 10	2 4		—	—	Oct.
10	12	Mrs. K. F. Graham,	Jan. 16	67	4 14	7 0	15	21	19	18	—	8	17	19	15	9	7	1	107	42	3	152	55	36 0¾	2 4	(a) 968	—	—	Oct., Jan.
		Ballagh Lodge,	"	68	4 8	6 0	7	18	5	9	21	21	21	24	24	15	22	11	195	3	—	198	30	45 3	2 7	lb. oz. dr.	—	—	Oct.
		Donadea,	"	69	4 9	5 10	18	17	19	21	20	20	18	23	22	16	16	10	211	7	2	220	57	52 0	2 7	(b) 137 1 13	—	—	Apl.
		Co. Kildare.	"	70	4 14	D	15	17	16	16	D	—	—	—	—	—	—	—	1	15	48	64	16	16 10½	1 14	(c) 27.2 oz.	1	—	Oct.
			"	71	4 8	D	13	22	19	2	9	20	5	—	D	—	—	—	14	71	5	90	52	23 5¾	2 1	(d) £11 12 5½	—	—	Oct.
			"	72	4 11	5 12	17	23	22	21	24	22	24	24	19	23	15	10	107	135	2	244	66	58 3½	2 3		—	—	*July*.
11	21	Mrs. J. Fahy,	Jan. 9	109	4 8	9 0	—	4	19	20	20	19	18	15	5	1	—	—	108	13	—	121	27	29 9¼	2 5	(a) 977	—	—	Oct., June
		Corbally,	Mar. 5	110	4 8	6 0	14	25	25	24	3	14	16	15	13	24	4	8	25	139	21	185	55	44 6¼	2 1	lb. oz. dr.	—	—	Oct., Jan., July.
		Ballygluinin,	Jan. 9	111	4 6	7 4	—	—	4	21	22	25	25	21	24	17	19	7	154	31	—	185	7	42 0½	2 5	(b) 137 9 5	—	—	Oct., *July*.
		Co. Galway.	Mar. 5	112	3 10	6 14	—	—	—	20	22	23	23	23	21	16	16	9	119	53	1	173	6	39 0½	2 5	(c) 27.0 oz.	—	—	Oct.
			Feb. 26	113	4 5	7 0	—	—	16	15	20	21	22	18	19	18	13	6	49	116	3	168	20	35 8¼	2 3	(d) £11 8 10½	—	—	Oct.
			Mar. 5	114	4 6	5 4	—	17	19	20	14	9	15	19	11	15	6	—	132	12	1	145	41	34 9¼	2 6		—	—	Oct., July.
*†	9	Mrs. K. O'Driscoll,	Feb. 10	49	5 8	6 0	13	18	23	23	13	23	26	26	26	23	25	10	1	158	90	249	33	55 6¾	2 0	(a) 938	5	—	*July*.
		Lisloose	"	50	5 8	6 0	22	22	21	5	18	23	26	26	8	24	12	10	5	97	115	217	14	48 5	2 0	lb. oz. dr.	1	1	Jan., July.
		Tralee,	"	51	5 10	D	11	D	—	—	—	—	—	—	—	—	—	—	—	—	11	11	—	2 9	1 12	(b) 118 10 3	1	—	—
		Co. Kerry.	"	52	5 6	6 4	19	23	24	21	16	20	19	18	14	3	18	10	144	58	3	205	68	50 1	2 4	(c) 24.3 oz.	—	—	—
			"	53	5 9	D	19	1	—	—	6	D	—	—	—	—	—	—	—	2	24	26	2	6 6½	1 14	(d) £10 16 9½	2	—	—
			"	54	5 4	6 0	11	23	22	23	22	24	25	23	23	11	12	11	2	153	75	230	43	53 2¼	2 0		1	1	Aug.
†	11	Mrs. R. B. Eadie,	Feb. 26	61	5 12	6 12	18	20	21	14	17	17	2	2	—	—	—	—	1	80	30	111	41	29 0¾	2 0	(a) 855	—	—	Mar., *May*.
		The Poplars,	"	62	5 13	7 8	24	22	21	19	19	15	16	10	14	10	8	5	51	115	17	183	56	45 0½	2 2	lb. oz. dr.	—	—	*July*.
		Beaufort,	"	63	4 9	D	20	21	18	18	—	20	17	D 3	—	—	—	—	19	88	10	117	59	29 10½	2 1	(b) 113 13 1	—	—	Jan.
		Co. Kerry.	Mar. 4	64	5 5	6 3	24	9	17	—	—	14	19	22	25	11	15	10	104	57	5	166	45	37 7¾	2 4	(c) 25.6 oz.	1	2	Dec., Apl.
			Feb. 26	65	5 7	7 4	24	25	19	14	8	11	5	3	—	—	3	—	29	61	22	112	49	29 3	2 1	(d) £10 11 10¾	—	—	June, *May*.
			"	66	5 0	6 2	26	7	15	20	19	18	21	—	18	—	13	9	88	73	5	166	48	41 0¼	2 3		—	3	Nov., July.

*Disqualified under Clause 26 (more than 20 per cent. second grade eggs) †Disqualified under Clause 26 (pen produced less than 960 eggs). D=Dead.

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen. (d) Total value from Pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
*†	25	Miss B. Quain, Anglesboro', via Mitchelstown, Co. Limerick.	1941 Feb. 24	133	4 4	D	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(a) 830	—	—	Oct.
			"	134	4 10	D	—	—	—	13	20	15	5	—	6	14	7	D	17	53	10	80	—	19 1½	2 2	lb. oz. dr.	—	—	Oct
			"	135	5 0	5 10	18	23	19	21	21	19	22	21	21	13	20	10	1	119	113	233	38	52 11	2 0	(b) 104 14 0	—	—	Oct
			"	136	4 10	7 3	—	—	20	24	23	22	22	19	21	23	21	9	68	135	1	204	26	47 8	2 3	(c) 24 3 oz	—	—	Oct
			April 11	137	4 0	6 8	—	19	19	21	23	22	21	21	17	17	17	6	11	89	103	203	6	45 11	2 0	(d) £9 11 2½	2	—	Oct
			"	138	4 0	D	—	—	15	22	22	22	21	8	—	D	—	—	—	13	97	110	4	25 8	1 14		12	—	Oct
†	18	Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.	Feb. 21	91	6 5	D	19	5	—	6	24	25	D6	—	—	—	—	—	6	57	22	85	19	21 5¼	2 0	(a) 728	—	—	Nov.
			"	92	6 14	D	—	—	—	12	15	21	19	10	3	D	—	—	46	33	1	80	1	18 8½	2 4	lb. oz. dr.	—	—	Oct
			Feb. 13	93	6 14	D	4	4	22	16	21	19	6	2	D	—	—	—	28	60	6	94	32	24 8¼	2 2	(b) 96 13 10	—	—	—
			Feb. 21	94	7 8	7 12	21	6	18	8	18	15	21	15	13	19	17	9	137	40	3	180	43	42 6	2 4	(c) 25 5 oz.	—	—	—
			"	95	6 15	D	14	18	15	—	5	20	24	11	D	—	—	—	6	85	16	107	39	25 7¾	2 1	(d) £8 16 6¼	—	—	Dec
			Feb. 13	96	6 4	6	18	13	16	22	18	19	11	11	12	14	20	8	18	115	49	182	24	45 8	2 0		—	—	—
†	14	Mrs. B. Dempsey, Forest House, Mountmellick, Laoighis.	Feb. 18	73	5 9	6 0	5	—	—	—	15	20	19	22	21	19	13	1	32	92	11	135	1	28 8¼	2 2	(a) 733	—	—	Oct
			"	74	5 11	6 6	4	18	12	—	9	24	20	9	20	—	15	12	4	95	17	143	17	31 11	2 0	lb. oz. dr.	—	1	*July*
			"	75	5 13	D	12	—	—	—	D	—	—	—	—	—	—	—	—	6	6	12	6	3 1½	2 0	(b) 97 15 3	1	—	Oct.
			"	76	5 12	8 0	8	17	9	—	10	21	17	16	5	6	3	5	33	69	15	117	28	27 0½	2 2	(c) 25 7 oz	1	—	Dec., *July*
			"	77	5 13	7 0	9	—	7	9	24	23	27	26	4	24	3	10	68	89	9	166	10	37 8	2 3	(d) £8 4 1¼	1	1	Oct., July.
			"	78	6 3	6 8	15	8	1	3	18	19	21	21	20	15	15	1	123	33	4	160	20	35 11	2 4		—	—	*Dec.*
†	27	Mrs. M. E. Prendergast, Lauragh, Cappoquin, Co. Waterford.	Feb.	139	4 10	5 10	—	6	4	18	21	18	19	23	8	8	3	—	—	1	127	128	—	26 11¾	1 13	(a) 477	11	—	Oct.
			"	140	4 10	6 12	—	8	17	22	18	20	23	17	6	19	6	10	125	37	4	166	28	30 5	2 5	lb. oz. dr.	—	—	Oct., July.
			"	141	5 0	6 6	19	19	8	—	13	26	18	10	17	16	11	8	9	130	26	165	33	37 10¼	2 0	(b) 61 12 4	—	2	Oct., May, *May.*
			"	142	6 1	D	16	2	D	—	—	—	—	—	—	—	—	—	8	7	3	18	15	4 9¾	2 1	(c) 24 9 oz.	—	—	Oct
			"	143	5 0	D	—	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	(d) £5 9 0¾	—	—	Oct
			"	144	4 2	D	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	—	Oct.

*Disqualified under Clause 26 (more than 20 per cent. second grade eggs). †Disqualified under Clause 26 (pen produced less than 960 eggs). D=Dead.

SECTION III.—RHODE ISLAND RED—16 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen (b) Total weight. (c) Av. Wt. per dozen (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
1	46	Mr. M. Fitzgibbon,	1941 Mar. 12	229	4 11	6 0	12	—	24	22	20	18	25	24	28	22	25	11	76	154	1	231	10	53 8	2 3	(a) 1,331	—	—	Oct.
		Gurrane,	,,	230	4 12	5 15	—	—	18	23	23	25	26	28	26	25	22	10	34	188	4	226	23	51 8½	2 2	lb. oz. dr	—	—	Oct.
		Kilmeedy,	,,	231	5 2	6 12	10	—	—	13	23	24	25	23	23	20	20	9	135	54	1	190	10	42 7½	2 5	(b) 183 5 1	—	—	Oct., *July.*
		Co. Limerick.	,,	232	4 14	6 4	9	16	17	18	15	20	25	24	23	22	19	8	119	95	2	216	44	50 1	2 3	(c) 26.4 oz.	—	—	*July*
			,,	233	4 8	6 0	—	11	23	22	25	26	27	25	23	23	20	8	112	121	—	233	39	54 5	2 3	(d) £15 6 9½	1	—	Oct.
			,,	234	5 4	6 4	17	22	10	9	22	25	23	25	24	23	23	12	132	102	1	235	18	54 3½	2 3		—	—	Oct
2	45	Mrs. K. Cuddihy,	Feb. 10	223	5 8	5 11	19	22	25	23	25	23	25	20	25	15	14	13	6	139	110	255	61	58 3½	1 15	(a) 1,254	1	—	*June*
		Hillside P.F.,	,,	224	5 13	7 0	19	23	23	21	22	21	25	23	4	19	18	7	133	89	3	225	67	54 6½	2 3	lb. oz. dr.	—	—	July
		Gleamore,	,,	225	6 1	7 0	25	3	—	1	22	26	24	24	22	19	19	14	28	157	14	190	24	41 [illegible]	2 2	(b) 166 12 2	—	—	Oct.
		Co. Kilkenny.	,,	226	6 12	7 6	4	11	17	21	22	11	14	17	20	19	10	6	113	59	—	172	35	40 11¾	2 1	(c) 26.0 oz	—	—	Oct., *July.*
			,,	227	5 9	5 14	—	—	22	23	25	23	22	21	18	10	4	12	34	141	5	180	27	42 3¼	2 2	(d) £11 12 7½	—	—	Oct., July.
			,,	228	5 14	7 0	13	—	18	25	23	22	24	24	24	19	19	12	197	22	4	223	[illegible]	52 1¼	2 6		—	—	Oct., July.
3	36	Mrs. M. A. Miller,	Feb. 3	181	5 8	6 6	16	9	2	21	20	23	18	22	18	18	13	8	97	88	3	188	30	43 11¼	2 3	(a) 1,184	—	—	Nov.
		Millview,	,,	182	5 0	5 12	18	19	20	19	18	21	24	26	17	11	18	9	116	101	3	220	60	52 3½	2 3	lb. oz. dr	—	—	—
		Rathowen,	,,	183	5 9	6 14	15	16	18	19	17	18	21	16	20	20	17	—	156	40	1	197	53	46 11	2 4	(b) 162 6 14	—	—	—
		(Co. Longford)	,,	184	5 5	6 3	17	14	17	6	3	18	23	24	23	21	23	11	38	110	22	208	49	44 0¾	2 1	(c) 26.3 oz.	—	—	Jan.
			,,	185	5 12	6 9	19	13	10	5	—	15	20	19	19	17	10	8	143	12	—	155	45	35 1¼	2 5	(d) £13 15 4½	1	—	Jan., *July.*
			Feb. 27	186	5 8	6 7	23	20	21	19	19	21	22	24	13	21	19	2	50	109	65	224	25	52 8½	2 1		—	—	—
4	29	Mrs. E. O'Donnell,	Mar. 1	151	6 0	8 8	18	17	—	—	18	26	25	19	17	5	11	2	24	120	14	158	31	35 8¼	2 2	(a) 1,167	—	—	Nov.
		Kilbreedy West,	,,	152	6 4	7 8	21	24	23	22	23	23	25	16	1	—	—	—	20	152	6	178	67	41 10¼	2 1	lb. oz. dr.	—	—	June, *May*
		Kilmallock,	,,	153	5 0	6 0	12	14	—	—	18	19	22	27	22	24	22	11	3	168	20	191	18	42 0½	2 0	(b) 150 2 11	—	—	Nov.
		Co. Limerick.	,,	154	5 8	7 8	—	3	26	26	26	26	25	28	26	25	14	11	1	157	78	236	15	52 11½	2 0	(c) 24.7 oz	—	—	July, *Oct.*
			,,	155	6 6	7 4	13	18	—	19	25	24	25	22	14	14	13	7	41	141	12	194	25	45 1½	2 2	(d) £13 8 10	—	—	Nov
			,,	156	5 0	6 2	—	8	18	22	22	23	25	27	22	22	11	10	5	181	24	210	20	48 1¾	2 1		1	—	July, *Oct.*
5	48	Mrs. K. Earl,	Mar. 24	145	5 3	6 2	10	7	19	15	18	20	20	18	16	20	20	9	8	174	10	192	30	44 11	2 2	(a) 1,141	—	—	Oct., *July.*
		Grantstown House,	Jan. 22	146	5 9	7 10	—	10	23	19	22	21	23	20	—	—	—	—	88	50	—	138	35	33 11¾	2 4	lb. oz. dr	—	—	Oct., June, *May.*
		Waterford.	Feb. 23	147	5 3	6 2	14	19	18	18	19	21	22	24	21	21	22	10	90	130	9	229	50	53 7½	2 3	(b) 153 10 14	1	—	*July.*
			Jan. 22	148	4 14	5 8	12	—	—	2	15	18	22	18	15	18	14	8	67	73	2	142	11	31 5½	2 3	(c) 25.9 oz.	—	—	Oct., *July.*
			Feb. 23	149	4 9	5 14	10	22	22	21	20	20	21	25	24	24	21	11	172	67	2	241	57	56 10¼	2 4	(d) £13 4 3¾	—	—	July.
			Jan. 22	150	4 14	6 15	12	—	2	21	23	23	23	23	21	24	19	8	1	116	82	199	12	43 5¾	2 0		—	—	Oct., July

SECTION III.—RHODE ISLAND RED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival (lb. oz.)	Weight At close of Test (lb. oz.)	1-Oct. 28	-Nov. 25	-Dec. 23	-Jan. 20	-Feb. 17	-Mar. 17	-Apr. 14	-May 12	-June 9	-July 7	-Aug. 4	5-Aug. 18	Special Grade	First Grade	Second Grade	Total	Under weight [illegible]	Value per Pullet (s. d.)	Average Weight of Egg per Pullet (oz. dr.)	(a) Total eggs; (b) Total weight; (c) Av. Wt. per dozen; (d) Total value	Pullets Preserved [illegible]	Number of times Broody	Date of moulting (Check months in italics)
†	33	Miss M. O'Donovan,	1941 Jan-Feb.	175	4 12	5 8	18	18	12	—	10	18	23	26	24	21	22	10	91	110	1	202	47	[illegible]	2 3	(a) [illegible]50	—	—	Dec.
		Dromore,	,,	176	5 0	D	20	21	15	—	—	—	—	—	—	—	—	—	5	11	10	56	46	[illegible]	[illegible] 0	lb. oz. dr.	—	—	—
		Villierstown,	,,	177	4 8	6 0	22	23	17	5	21	22	25	27	25	[illegible]	23	12	[illegible]	[illegible]	1	251	61	[illegible]	[illegible] 5	(b) 130 [illegible] 12	—	—	Oct.
		Cappoquin,	,,	178	5 10	7 10	7	—	9	—	[illegible]	25	25	24	21	14	20	3	18	119	23	160	13	[illegible]	2 1	(c) [illegible] oz.	—	1	Oct.
		Co. Waterford.	,,	179	5 0	6 2	23	22	16	—	[illegible]	27	[illegible]	23	17	16	23	9	166	43	2	211	59	[illegible]	2 4	(d) £11 4 5½	—	2	Dec.
			,,	180	5 5	D	24	18	18	—	6	6	D	—	—	—	—	—	36	34	—	[illegible]	58	[illegible] 11	2 2		—	—	Oct.
†	43	Mr. W. Murphy,	Feb 28	211	5 2	7 4	9	11	—	—	[illegible]	21	22	12	16	17	[illegible]	7	51	88	3	142	17	51 11	— [illegible]	(a) [illegible]27	—	—	Nov.
		Skeeter Park,	,,	212	4 10	5 10	—	5	—	11	17	19	23	21	8	22	[illegible]	—	20	77	37	131	5	[illegible] 4	[illegible]	lb. oz. dr.	2	1	Nov., July.
		Clearistown,	Mar. 26	213	5 6	7 6	—	—	—	11	24	27	20	17	12	10	14	—	65	67	3	135	—	[illegible]	[illegible]	(b) 136 [illegible] 11	—	1	Oct., July, *Oct.*
		Co. Wexford.	,,	214	5 0	7 6	24	16	19	20	[illegible]	[illegible]	13	18	11	15	12	10	135	58	2	195	62	[illegible] 7½	2 [illegible]	(c) 26.3 oz.	—	2	July.
			,,	215	5 3	D	22	19	1	—	21	26	20	17	—	—	—	—	12	103	10	125	[illegible]	30 2	2 [illegible]	(d) £10 17 [illegible]	—	—	Dec.
			,,	216	4 15	8 8	5	11	—	23	21	21	20	22	25	23	20	11	201	2	—	206	22	47 [illegible]	2 8		1	—	Nov., *July.*
†	44	Mrs. D. H Edwards	Feb. 4	217	4 12	6 4	—	—	4	2	[illegible]	21	[illegible]	[illegible]	21	8	15	3	28	110	—	158	6	29 9	2 2	(a) [illegible]24	—	2	Oct., Aug.
		Drumgowan,	,,	218	5 4	5 14	—	[illegible]	21	1	[illegible]	[illegible]	[illegible]	27	[illegible]	24	20	10	19	144	26	189	28	40 11	2 1	lb. oz. dr.	—	—	Oct.
		Burt,	,,	219	5 8	7 8	—	—	10	18	16	[illegible]	22	23	15	10	15	6	110	43	1	154	14	[illegible]	2 5	(b) 125 5 11	—	—	Oct.
		Speenogue P.O.,	,,	220	5 4	7 12	5	16	22	20	[illegible]	[illegible]	20	16	21	4	8	4	29	134	14	177	45	42 1	2 2	(c) 26.0 oz.	—	—	Aug.
		Co. Donegal.	,,	221	4 10	6 4	—	—	15	4	—	[illegible]	22	23	24	14	6	12	67	62	—	129	19	27 10	2 3	(d) £10 5 2½	—	1	Oct.
			,,	222	5 4	6 6	—	—	—	—	12	19	[illegible]	22	19	21	18	3	49	84	4	137	—	29 0½	2 5		—	—	Oct.
†	38	Miss Mc Irwin,	Feb.	187	5 0	6 12	15	16	5	21	22	23	25	22	20	21	12	9	37	171	3	211	39	49 2½	[illegible] 2	(a) 864	—	—	Oct.
		Glen arrig,	,,	188	4 8	6 4	—	13	6	16	16	18	19	16	8	8	[illegible]	2	118	12	—	130	22	[illegible]	2 5	lb. oz. dr.	—	—	Oct., July.
		Delgany,	,,	189	4 8	6 10	—	—	7	14	9	—	—	—	—	—	—	—	28	2	—	30	10	8 6½	2 7	(b) 121 15 11	—	—	Oct., June.
		Co. Wicklow.	,,	190	4 8	5 14	—	2	15	19	19	18	20	20	19	15	13	—	158	2	—	160	21	37 1	2 8	(c) 27.1 oz.	—	—	Oct., *July.*
			,,	191	4 8	5 5	—	4	20	20	19	29	23	22	20	19	16	10	[illegible]	143	1	193	27	41 9	2 3	(d) £10 2 2½	—	—	Oct., Aug.
			,,	192	4 6	6 0	—	—	4	14	18	[illegible]	23	27	1	18	7	11	82	58	—	140	6	51 11½	2 4		—	2	Oct., July.
†	39	Rev. Bro. Dominick,	Mar.	193	4 14	5 1	—	13	23	27	25	24	27	7	25	—	—	—	16	124	1	171	12	41 8¼	2 2	(a) 835	—	3	Oct., May.
		Agricultural College,	,,	194	5 12	6 10	7	16	5	—	4	5	10	2	12	4	4	1	61	9	—	70	28	16 6¼	2 9	lb. oz. dr.	—	—	Dec.
		Mountbellew,	,,	195	4 12	5 14	—	—	7	13	1	26	27	26	22	18	22	6	68	92	8	168	10	36 6¼	2 3	(b) 114 4 11	—	—	Oct.
		Co. Galway.	,,	196	4 8	5 6	19	22	21	20	22	22	21	23	23	20	20	11	9	210	25	244	64	57 6¼	2 0	(c) 26.3 oz.	2	—	*July.*
			,,	197	5 0	5 14	—	—	6	10	23	23	26	25	15	21	11	5	116	47	2	165	10	36 11¾	2 4	(d) £9 14 1½	—	1	Oct. July.
			,,	198	5 6	D	—	8	—	9	D	—	—	—	—	—	—	—	17	—	—	17	8	4 9½	2 12		—	—	Nov.

†Disqualified under Clause 26 (pen produced less than 960 eggs). D=Dead.

SECTION III.—RHODE ISLAND RED—continued

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1-Oct. 23	Oct. 23-Nov. 25	Nov. 23-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
6	32	Miss V. Smith, Bridge House, Bettystown, Co. Meath.	1941 Feb.-Mar.	169	5 1	5 14	20	22	17	17	20	21	21	22	22	21	18	10	10	122	99	231	30	52 5½	1 15	(a) 1,123	2	—	[illegible]
			,,	170	5 0	6 10	25	20	12	—	10	22	25	21	22	17	17	1	112	83	—	195	37	41 7¼	2 4	lb. oz. dr. (b) 152 4 2	—	—	Dec.
			,,	171	4 15	6 0	15	17	15	—	7	23	25	26	22	24	24	11	173	36	—	209	47	47 1¼	2 5	(c) 26.0 oz	—	—	Dec., *Aug.*
			,,	172	4 12	7 8	21	3	—	—	25	21	16	25	18	13	13	[illegible]	122	39	2	163	21	36 10½	2 4	(d) £12 13 7	—	—	Oct., *July.*
			,,	173	4 10	5 10	—	14	13	3	24	27	28	24	4	23	16	[illegible]	33	130	17	180	24	40 10¼	2 2		—	2	Oct., May.
			,,	174	5 0	6 8	—	—	—	—	23	20	24	22	19	12	18	7	51	90	4	145	—	31 7½	2 3		1	2	Oct., July.
7	31	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.	Feb. 27	163	5 3	5 10	—	—	12	21	22	24	24	20	17	5	—	1	12	130	4	146	17	33 11¼	2 2	(a) 1,077	—	—	Oct., June
			,,	164	5 6	6 4	3	—	7	21	20	21	20	25	26	25	21	11	62	137	13	212	13	47 6¾	2 2	lb. oz. dr. (b) 174 8 15	—	—	Oct.
			,,	165	5 0	7 2	14	21	12	—	19	23	24	23	21	16	18	9	198	2	1	201	46	46 0½	2 10	(c) 27.6 oz.	—	—	Dec.
			,,	166	5 11	8 10	—	—	9	20	18	15	19	15	21	15	15	6	140	16	—	156	14	35 10¾	2 7	(d) £12 5 0¼	1	—	Oct.
			,,	167	5 0	6 10	—	—	6	24	20	22	22	24	23	21	9	4	161	16	—	177	11	40 2¾	2 6		—	—	Oct., *July*
			,,	168	4 14	6 10	1	18	9	3	15	19	21	21	22	22	21	10	31	146	8	185	27	41 5½	2 2		—	—	Oct., *July.*
8	41	Mrs. K. Cuddihy, Hillside P.F., Glenmore, Co. Kilkenny.	Feb. 21	205	5 10	6 8	19	25	7	—	13	20	28	25	20	4	6	5	51	127	6	184	49	42 3¼	2 2	(a) 1,040	—	—	Dec.
			,,	206	5 2	5 14	7	16	—	2	20	22	25	24	23	25	19	12	17	150	26	193	4	42 5¼	2 1	lb. oz. dr. (b) 137 12 13	2	—	Dec., *July*
			,,	207	5 1	6 4	22	26	22	25	27	23	24	21	22	19	15	9	30	162	63	255	64	60 0¼	2 1	(c) 25.2 oz	2	—	*July.*
			,,	208	5 13	6 14	20	22	9	—	18	25	23	24	28	16	19	13	34	165	18	217	44	49 1¼	2 2	(d) £12 0 7	—	—	Dec., *July*
			,,	209	5 8	D	16	24	D7	—	—	—	—	—	—	—	—	—	—	38	9	47	53	12 6¼	2 0		—	—	—
			,,	210	5 10	7 4	4	—	—	10	22	24	24	23	18	14	10	4	98	53	2	153	2	34 1½	2 4		1	—	Oct.
9	30	Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.	Mar. 8	157	4 8	6 12	19	23	19	21	21	24	15	21	25	20	20	9	155	80	2	237	66	56 7	2 4	(a) 1,020	—	—	Oct.
			,,	158	4 10	6 0	—	11	14	—	20	21	24	27	25	22	12	11	148	40	2	190	25	42 4	2 5	lb. oz. dr. (b) 141 14 5	—	—	Oct., *July.*
			,,	159	5 0	7 2	—	8	23	14	15	13	7	10	3	—	—	—	11	69	10	93	34	23 6¾	2 1	(c) 26.5 oz.	1	—	Oct., June, *May.*
			,,	160	4 14	5 3	11	18	17	17	19	21	24	21	3	2	—	—	152	2	2	156	49	37 10½	2 7	(d) £12 0 1	—	—	Oct., May.
			,,	161	4 10	5 12	—	22	18	—	12	23	25	25	21	23	20	11	—	133	68	201	20	43 9¼	2 0		1	—	Oct.
			,,	162	4 6	5 14	2	23	16	3	23	26	27	22	6	3	1	—	42	108	2	152	41	35 11	2 3		—	—	Oct., June, *May.*
10	40	Miss M. Keane, Killurin, Co. Wexford.	Feb. 18	199	5 6	6 0	4	—	3	18	18	20	22	22	19	15	12	11	85	73	6	164	11	36 10½	2 3	(a) 1,020	—	1	Oct., July.
			,,	200	5 5	7 0	—	6	—	—	19	22	25	24	24	23	24	10	148	28	1	177	5	38 5½	2 5	lb. oz. dr. (b) 157 6 11	—	—	Oct.
			,,	201	5 4	6 6	6	—	—	—	22	22	27	20	21	24	14	10	1	13	152	166	1	32 3	1 14	(c) 25.9 oz.	7	—	Oct., *July.*
			,,	202	4 8	5 8	4	—	11	23	22	23	23	22	12	14	9	8	119	50	2	171	29	40 1¾	2 4	(d) £11 5 11¼	—	2	Oct., June.
			,,	203	5 1	5 8	—	—	—	11	19	19	21	23	22	21	—	—	124	12	—	136	—	29 9	2 5		—	—	Oct., July, *Oct.*
			,,	204	6 0	7 6	14	23	3	4	23	27	27	18	26	13	15	13	23	142	41	206	19	40 5½	2 1		—	2	Dec., *July.*

D = Dead.

SECTION III.—RHODE ISLAND RED.—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1-Oct 28	Oct. 29-Nov 25	Nov 26-Dec 23	Dec 24-Jan 20	Jan 21-Feb 17	Feb 18-Mar 17	Mar 18-Apl 14	Apl 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
†	47	Sister-in-Charge, St. Martha's College, Sion, Navan, Co. Meath.	1941 Feb. 7	433	5 2	5 14	17	7	3	9	4	17	21	21	21	23	17	9	166	3	—	169	27	37 9½	2 10	(a) 780	—	—	—
			"	434	5 13	D	15	10	20	16	18	13	D1	—	—	—	—	—	40	53	—	93	50	25 1¼	2 3	lb. oz. dr.	—	—	—
			Jan. 30	435	6 4	7 4	13	1	—	12	13	17	11	6	8	10	7	4	11	81	13	105	13	24 7¼	2 1	(b) 109 9 11	1	—	Nov., *July.*
			Feb. 21	436	5 5	D	—	4	3	20	21	21	18	3	5	—	D5	—	12	77	11	100	8	24 5¼	2 1	(c) 27 0 oz	—	—	Oct.
			Feb. 14	437	5 11	7 0	25	26	24	11	—	—	23	16	25	16	16	7	60	122	7	189	72	44 6¼	2 2	(d) £9 5 2½	—	4	Jan.
			Feb. 21	438	5 8	D	11	3	14	19	1	9	23	15	20	D9	—	—	100	22	2	121	30	28 5¾	2 5		—	—	Jan.

†Disqualified under Clause 26 (pen produced less than 960 eggs). D=Dead.

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—17 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of Test lb. oz.	Eggs Laid Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moultings (Neck moults in italics)
*	64	Mrs. M O'Reilly,	1941 Feb. 14	325	5 3	7 14	7	23	26	23	23	22	26	21	21	22	19	11	111	128	5	244	60	58 0¼	2 3	(a) 1,394	—	—	Oct.
		St. Johnstort,	,,	326	5 0	7 0	8	25	25	21	23	21	20	21	18	18	18	7	89	130	6	225	62	57 0	2 3	lb. oz. dr.	1	—	Oct., July.
		Ardee,	,,	327	4 12	6 10	10	18	22	12	1	15	25	28	22	19	19	10	47	123	31	201	27	45 3¼	2 2	(b) 181 10 10	3	—	Oct., Feb., *July*.
		(Co. Meath.)	,,	328	4 8	6 0	14	17	22	20	21	24	26	26	27	26	24	10	62	191	4	257	54	60 0¼	2 3	(c) 25.0 oz	1	—	Oct., *July*.
			,,	329	4 9	6 14	—	12	24	22	25	22	23	25	26	19	15	8	1	38	182	221	6	47 3½	1 15	(d) £16 1 1½	—	—	Oct., *July*.
			,,	330	4 12	6 8	17	24	26	24	23	25	25	17	21	16	20	7	—	118	128	246	11	56 6	1 15		1	—	Oct
1	60	Mr. W. Murphy,	Feb. 1	301	5 6	8 3	19	23	13	—	14	24	24	24	24	18	20	8	151	60	—	211	55	48 5¼	2 4	(a) 1,329	—	—	Dec.
		Skeeter Park,	,,	302	5 9	7 14	—	—	17	18	17	15	21	22	20	20	24	11	143	42	—	185	22	42 5¼	2 5	lb. oz. dr.	—	—	Oct
		Clearestown,	,,	303	5 10	7 0	19	23	17	18	19	22	25	24	23	22	21	12	51	180	14	245	51	57 3¼	2 2	(b) 184 11 14	2	—	—
		Co. Wexford.	,,	304	5 0	6 4	22	17	15	24	22	21	24	22	22	19	20	10	195	41	2	238	57	56 4¾	2 5	(c) 26.7 oz	—	—	—
			,,	305	5 11	7 14	4	24	15	8	13	22	25	24	26	20	20	9	148	62	—	210	43	48 0¼	2 5	(d) £15 9 6½	—	1	Oct., Feb.
			,,	306	5 8	7 14	23	23	18	20	22	21	25	25	22	20	13	8	47	186	7	240	64	56 10¼	2 2		—	—	—
2	62	Mrs. H. Langrell,	Feb	313	5 0	5 8	22	17	—	8	22	23	27	27	25	22	20	11	59	165	—	224	39	51 0¼	2 3	(a) 1,306	—	—	Dec.
		Killinure,	,,	314	5 2	6 10	20	21	20	15	18	18	17	10	16	9	8	3	153	25	—	178	66	43 11¼	2 5	lb. oz. dr.	—	—	*June*.
		Tullow,	,,	315	4 12	6 8	17	16	19	20	22	20	24	25	23	23	17	9	217	18	—	235	56	55 4	2 6	(b) 185 1 14	—	—	—
		(Co. Wicklow).	Jan.	316	5 9	7 10	21	21	19	—	—	24	28	25	27	26	24	10	72	152	4	228	64	51 6½	2 2	(c) 27.2 oz	—	—	Dec.
			Feb.	317	4 8	6 9	18	19	22	18	18	18	20	18	17	11	7	9	77	113	5	195	62	47 1½	2 3	(d) £15 6 10½	—	1	Oct., Aug
			Jan.	318	5 9	6 5	19	23	20	16	18	22	24	25	24	23	21	11	243	3	—	246	64	57 10½	2 8		—	—	—
3	51	Miss M. O'Donovan.	Jan. 30	253	5 14	8 3	23	22	12	—	17	26	22	21	25	20	20	8	26	133	57	216	51	48 1¼	2 0	(a) 1,190	—	—	Dec.
		Dromore,	,,	254	5 11	7 6	11	1	17	22	23	23	26	26	25	23	22	11	200	24	6	230	29	53 0½	2 5	lb. oz. dr.	—	—	Oct.
		Villierstown,	,,	255	5 2	6 0	22	24	12	—	9	23	21	25	24	24	23	14	73	134	14	221	56	50 0	2 2	(b) 160 4 11	—	—	Dec.
		Cappoquin,	,,	256	5 1	D	19	17	D9	—	—	—	—	—	—	—	—	—	42	3	—	45	45	12 3½	2 4	(c) 25.9 oz	—	—	—
		Co. Waterford	,,	257	4 15	6 10	11	19	12	—	11	25	24	25	23	20	23	9	148	52	5	205	42	46 2½	2 4	(d) £13 12 3¼	—	—	Oct.
			,,	258	4 12	6 0	24	21	25	9	21	28	26	27	26	28	24	13	16	205	51	272	39	62 5¼	2 1		—	—	Jan., July.
				U.T.	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	—	1	—	2½	2 0		—	—	—
4	65	E. Bean Mhic	Jan. 21	427	4 9	6 8	16	—	12	21	18	20	19	22	19	15	15	5	59	112	11	182	26	42 4¾	2 2	(a) 1,133	—	—	Nov.
		Dhomhnaill,	,,	428	4 14	5 14	18	—	15	23	22	22	26	27	27	23	22	12	38	195	4	237	34	54 10½	2 2	lb. oz. dr.	1	—	Nov.
		Imeall Atha,	,,	429	4 14	6 1	21	23	23	21	22	21	25	24	23	21	20	12	155	101	—	256	72	60 11¼	2 4	(b) 154 3 2	—	—	*July*.
		Baile an	,,	430	5 8	6 11	12	—	—	13	8	19	25	15	7	12	11	1	102	21	—	123	12	27 9¼	2 5	(c) 26.1 oz.	—	1	Nov., June.
		Fheirterigh,	,,	431	4 12	5 15	23	1	—	—	8	25	26	20	24	12	17	2	5	104	49	158	4	33 7¼	2 0	(d) £15 2 4½	3	1	Nov.
		Daingean Ui Cuise, Co. Chiarraidhe.	,,	432	4 14	7 7	21	22	17	11	21	17	15	21	14	12	6	—	126	51	—	177	61	42 9	2 4		—	—	July.

*Disqualified under Clause 26 (more than 20 per cent. second grade eggs). D = Dead. U.T. = Untrapped.

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov 25	Nov 26-Dec 23	Dec. 24-Jan. 20	Jan 21-Feb. 17	Feb 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1—Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
5	61	Mrs. L. Hayes,	1941 Feb. 24	307	4 14	6 10	21	22	1	26	25	20	24	26	23	20	24	10	33	196	16	245	39	57 2	2 1	(a) 1,116	—	—	Dec.
		Walshestown,	,,	308	5 3	6 4	23	9	7	22	24	24	23	21	23	23	24	13	209	28	2	239	42	55 8½	2 5	lb. oz. dr.	—	—	Dec.
		Castlemahon,	,,	309	4 10	D	—	22	D4	—	—	—	—	—	—	—	—	—	7	19	—	26	26	7 0¾	2 1	(b) 153 15 14	—	—	Oct.
		Newcastle West,	,,	310	5 0	7 0	12	23	7	—	24	24	27	24	27	20	24	12	65	151	8	224	38	50 5¼	2 3	(c) 26 5 oz.	—	—	Oct
		Co. Limerick.	,,	311	4 12	6 3	—	18	7	—	21	25	28	26	22	23	15	13	45	145	8	198	22	43 11	2 2	(d) £12 18 4¾	—	—	Oct., *July.*
			,,	312	5 2	8 0	—	16	22	20	26	25	20	20	17	12	—	6	162	22	—	184	43	44 1	2 6		—	—	Oct., July.
6	68	Mrs. T. Godwin,	Feb. 25	319	4 9	6 0	—	7	16	26	26	24	26	26	27	27	20	12	55	179	3	237	27	54 9¾	2 2	(a) 1,102	—	—	Oct., July.
		Belmont,	,,	320	4 12	7 10	—	11	—	—	—	—	—	—	—	—	—	—	6	4	1	11	10	2 11¼	2 1	lb. oz. dr.	—	—	Nov., July, *Oct.*
		Milltown,	,,	321	4 15	6 8	17	23	17	20	22	23	28	25	23	24	17	11	1	183	66	250	35	57 5¼	2 0	(b) 146 8 2	—	—	Oct., *July.*
		Co. Galway.	,,	322	4 12	7 0	14	23	12	18	25	25	27	22	24	12	14	13	10	198	21	229	34	53 5½	2 1	(c) 25 5 oz.	—	2	Oct.
			,,	323	4 14	8 10	10	22	15	15	16	11	17	16	11	8	5	—	50	83	13	146	37	35 3¼	2 3	(d) £12 17 2½	—	—	—
			,,	324	4 8	7 5	—	15	20	21	21	22	23	28	22	24	23	10	173	56	—	229	39	53 8	2 5		—	—	Oct., *July.*
7	50	Mrs. M. F. Smith,	Feb.-Mar.	247	4 9	5 14	—	—	—	8	22	20	25	24	25	25	20	8	171	6	—	177	—	38 9	2 7	(a) 1,127	—	—	Oct.
		Bridge House,	,,	248	4 11	6 4	11	7	—	—	21	23	24	23	25	25	12	3	128	44	2	174	17	38 3¼	2 4	lb. oz. dr.	—	—	Nov., July.
		Bettystown,	,,	249	4 8	5 5	19	8	—	—	9	24	28	27	23	24	23	10	74	121	—	195	27	42 10¾	2 3	(b) 157 9 10	—	—	Nov., *Nov.*
		Co. Meath.	,,	250	5 3	5 14	—	21	9	—	10	25	23	26	28	23	23	8	50	127	14	191	28	41 10½	2 2	(c) 26.8 oz.	—	—	Oct
			,,	251	4 13	6 8	16	12	5	16	13	15	22	21	19	23	19	12	103	87	3	193	34	44 4	2 3	(d) £12 9 6¾	—	—	—
			,,	252	4 15	5 8	—	—	4	7	23	23	26	27	23	27	26	11	130	67	—	197	4	43 5¼	2 4		—	—	—
*	68	Mrs. E. O'Donnell,	Mar. 16	235	5 8	7 8	—	—	14	—	9	27	27	24	23	25	25	11	81	96	8	185	11	40 2	2 5	(a) 1,086	—	—	Oct.
		Kilbreedy West,	,,	236	5 8	8 8	—	—	5	24	25	22	19	19	15	7	4	3	9	123	11	143	5	33 4½	2 1	lb. oz. dr.	—	—	Oct., *July.*
		Kilmallock,	Mar. 28	237	4 10	6 8	—	10	22	23	25	24	27	25	24	19	22	8	—	32	197	229	8	48 6½	1 14	(b) 138 3 12	8	—	Oct.
		Co. Limerick.	Mar. 16	238	5 5	7 4	16	23	9	5	23	20	25	27	24	12	8	—	7	156	29	192	28	43 6	2 0	(c) 24.4 oz.	—	—	Oct., *July.*
			,,	239	5 5	D	—	20	10	3	22	23	23	19	—	D	—	—	27	85	8	120	25	28 4½	2 2	(d) £12 0 11½	—	—	Oct.
			Mar. 28	240	5 12	6 0	—	12	24	20	22	20	25	22	19	20	22	11	1	52	164	217	2	47 0	1 15		1	—	*Oct.*
8	53	Miss J. Weston,	Mar. 25	265	5 0	6 8	7	11	—	6	20	21	12	17	20	21	22	11	135	30	3	168	16	38 0½	2 7	(a) 1,015	1	—	Nov., *July.*
		Ballymadrough,	Mar. 21	266	5 0	6 0	14	18	9	—	6	21	25	23	19	7	21	9	167	5	—	172	41	38 11¾	2 7	lb. oz. dr.	—	1	Oct
		Donabate,	Mar. 17	267	6 0	7 0	—	—	9	23	24	20	24	16	17	12	10	4	154	5	—	159	14	37 1¼	2 7	(b) 151 4 10	—	2	Oct., July.
		Co. Dublin.	,,	268	6 8	7 0	—	—	5	20	21	25	26	16	—	21	6	12	127	25	—	152	8	35 7¼	2 5	(c) 28 3 oz.	—	1	Nov., May, *Nov.*
			,,	269	6 10	7 9	7	—	4	—	19	22	24	27	28	28	26	14	178	21	—	199	11	43 4¼	2 6	(d) £11 18 3½	—	—	Oct., Aug.
			,,	270	6 0	7 6	—	—	14	26	23	24	24	23	23	22	13	3	66	128	1	195	19	45 2	2 3		—	1	Oct., July.

*Disqualified under Clause 26 (more than 20 per cent. second grade eggs). D=Dead.

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
9	54	Mrs. M. Kelleher,	1941 Feb. 27	271	5 0	5 12	11	24	16	—	8	22	27	26	25	23	23	7	9	193	10	212	43	47 7¼	2 1	(a) 1,016	—	—	Dec
		Kileedy,	„	272	5 2	5 14	23	1	—	—	9	22	27	15	17	20	24	2	10	116	34	160	16	34 7	2 0	lb oz. dr.	2	2	Nov., July.
		Ballagh,	„	273	5 0	7 12	—	15	14	—	10	20	24	24	23	20	20	11	17	159	5	181	27	40 1¾	2 0	(b) 134 15 8	—	—	Oct.
		Charleville,	„	274	4 12	7 9	—	—	2	—	17	19	23	19	5	14	15	12	51	72	3	126	2	27 6¾	2 3	(c) 25.5 oz.	—	2	Oct
		Co. Cork.	„	275	5 0	6 10	—	—	8	16	21	22	26	20	22	19	15	10	118	60	1	179	10	40 7¼	2 4	(d) £11 5 7½	—	—	Oct., *July*.
			„	276	4 11	6 4	23	5	—	—	10	21	25	24	12	16	16	6	25	129	4	158	28	35 0¾	2 2		—	2	Nov., *July*.
10	56	Mrs. M. J. Walker,	Jan. 14	283	4 8	6 10	22	7	13	17	7	20	17	18	15	9	9	11	121	42	2	165	47	39 3¼	2 4	(a) 965	—	4	Nov. *July*.
		Lower Woodhead,	„	284	4 10	5 14	—	—	20	17	20	21	23	19	19	19	18	8	23	152	9	184	24	42 3¾	2 2	lb oz. dr.	—	—	Oct
		Ballyloughan,	„	285	4 8	5 3	16	21	14	—	17	20	25	26	22	23	23	12	72	144	3	219	51	49 11¼	2 2	(b) 133 5 8	—	—	Dec.
		Bruckless,	Jan. 25	286	4 6	5 4	—	8	16	14	13	16	14	12	9	12	10	6	13	113	4	130	26	30 11	2 2	(c) 26.5 oz.	4	—	Oct.
		Co. Donegal.	„	287	4 8	5 10	—	6	17	4	9	19	22	19	14	18	9	11	142	6	—	148	26	33 4½	2 6	(d) £11 4 8¾	—	—	Oct., July
			„	288	5 0	6 12	—	12	19	14	12	14	10	11	9	10	7	1	100	18	1	119	34	28 11	2 6		—	—	Oct
11	49	Mrs. J. McCarthy,	Mar. 8	241	4 8	6 12	—	3	17	—	7	25	26	26	28	27	13	13	46	134	5	185	20	40 2¼	2 3	(a) 998	—	—	Oct
		Caherelly Castle,	„	242	4 6	6 8	—	—	9	—	9	21	8	21	17	12	13	13	19	94	10	123	8	26 11½	2 2	lb. oz. dr.	—	3	Oct
		Grange,	„	243	4 6	6 8	—	—	4	19	21	19	20	22	12	14	15	5	1	60	90	151	—	32 8½	1 15	(b) 131 6 6	4	—	Oct.
		Kilmallock,	„	244	4 9	6 4	—	—	—	9	20	23	26	25	24	25	25	12	33	154	2	189	—	41 4¾	2 2	(c) 25.3 oz.	—	—	Oct. *July*.
		Co. Limerick.	„	245	4 9	5 10	3	22	20	20	21	20	22	27	26	21	24	10	50	178	8	236	48	55 0¾	2 2	(d) £11 2 7	—	—	Oct.
			„	246	4 6	6 12	—	—	15	1	22	22	20	16	9	5	4	—	9	100	5	114	12	26 3	2 2		—	—	Oct. June, *May*.
*	52	Mrs. K. Heffernan,	Feb. 27	259	5 5	6 12	18	22	8	—	9	25	27	28	22	1	—	—	10	126	24	160	30	34 9	2 1	(a) 1,011	1	—	Dec. Jy. *Dec June*.
		Kearney Bay,	„	260	5 4	7 4	—	—	—	14	—	4	17	21	18	19	16	6	17	96	2	115	2	24 6¾	2 2	lb. oz. dr.	—	—	Oct., Feb., *July*.
		Glenmore,	„	261	4 14	7 12	—	8	4	6	22	20	23	23	19	18	16	7	132	34	—	166	12	37 1¼	2 5	(b) 136 5 9	—	—	Oct.
		Co. Kilkenny.	„	262	4 8	6 8	10	19	8	17	24	25	25	24	26	24	27	10	—	53	186	239	1	50 5¾	1 14	(c) 25.9 oz.	3	—	*Dec. July*.
			„	263	5 5	5 14	6	18	9	—	7	21	23	23	21	16	17	—	118	41	2	161	31	35 8¾	2 4	(d) £11 1 9½	—	—	Dec., *Dec.*
			„	264	5 7	5 15	—	16	4	19	23	21	22	22	22	20	1	—	162	7	1	170	23	39 1¾	2 7		—	2	Oct., *Aug*
†	55	Miss C. Mealiff,	Mar. 23	277	4 10	6 6	—	11	22	22	18	21	17	22	3	14	13	1	164	—	—	164	38	39 7	2 8	(a) 919	—	2	Oct., July.
		Ballinamona	„	278	4 14	7 4	—	19	14	—	13	24	28	25	23	25	28	12	110	97	4	211	31	47 1½	2 3	lb. oz. dr.	—	—	Dec., *Oct., July*.
		House,	„	279	4 12	8 2	—	—	—	17	22	16	18	20	12	6	4	—	115	—	—	115	—	26 4½	2 10	(b) 132 14 15	—	—	Oct.
		Tullamore	„	280	4 15	7 6	2	10	17	18	20	12	15	20	7	11	7	3	138	3	1	142	33	34 1½	2 7	(c) 27.8 oz.	—	—	Oct., July.
		Offaly.	„	281	4 9	6 10	—	2	14	16	13	12	7	4	—	—	—	—	63	5	—	68	19	17 8½	2 5	(d) £10 14 9	—	—	Oct., June, *Oct.*
			„	282	4 4	6 14	—	15	16	23	22	21	23	22	23	23	18	13	7	172	40	219	20	49 10¼	2 0		—	—	Oct.

*Disqualified under Clause 26 (more than 20 per cent. second grade eggs).

†Disqualified under Clause 26 (pen produced less than 960 eggs).

SECTION IV.—RHODE ISLAND RED STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs laid: Oct. 1-Oct 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar 17	Mar 18-Apl 14	Apl 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1—Dec. 30	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
†	58	Mrs. E. Hammersley	1941 Jan 1	295	5 0	6 3	5	11	21	8	19	22	18	14	6	6	15	7	107	43	2	152	35	36 7	2 4	(a) 909	—	—	June
		Ashvale,	Feb. 1	296	4 9	6 0	10	22	21	17	18	20	23	9	—	—	—	—	102	26	2	140	51	35 4½	2 4	lb. oz. dr.	—	—	Oct., June, *May.*
		Lattin,	„	297	4 8	6 0	7	—	25	22	24	27	21	26	18	22	24	10	8	131	90	229	30	51 8	2 0	(b) 125 2 12	—	—	Oct., *July*
		Tipperary.	Feb. 15	298	4 8	5 10	—	—	7	20	21	22	21	25	26	23	4	11	63	116	4	183	10	41 1	2 3	(c) 26 4 oz.	—	—	Oct., July.
			„	299	5 0	D	2	17	D4	—	—	—	—	—	—	—	—	—	12	11	—	23	23	0 2¼	2 2	(d) £10 13 6¾	—	—	Oct.
			„	300	4 12	5 14	—	—	18	20	21	20	17	16	21	22	18	9	165	17	—	182	23	12 6½	2 6		—	—	Oct.
†	57	Mrs. K. Kilduff,	Feb. 12	289	4 12	5 14	—	4	20	15	19	16	21	23	18	19	14	7	158	18	—	176	27	40 7½	2 6	(a) 820	—	—	Oct.
		Knockdrin,	„	290	4 14	D	11	15	19	6	11	6	12	4	D	—	—	—	27	54	6	87	49	22 5	2 2	lb. oz. dr.	—	—	—
		Mullingar,	„	291	5 4	5 8	11	19	20	17	15	17	24	18	16	11	—	—	136	20	2	168	54	40 0¾	2 4	(b) 109 12 1	—	—	June Oct., *June.*
		Co. Westmeath	„	292	4 12	D	16	10	—	—	14	23	11	—	D	—	—	—	1	10	63	74	10	17 1½	1 14	(c) 25 7 oz.	10	—	Nov.
			„	293	6 5	D	13	14	1	13	19	3	2	—	2	D	—	—	11	48	8	67	29	17 11	2 1	(d) £9 13 5	1	—	Nov., Jan.
			„	294	4 4	4 8	17	11	10	22	25	24	26	28	26	27	21	11	4	167	77	248	30	45 3	2 0		—	—	—

†Disqualified under Clause 26 (pen produced less than 960 eggs). D=Dead

SECTION V.—ANY NON-SITTING BREED—8 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb. oz.	Weight: At close of Test lb. oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov 25	Nov. 26-Dec 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct 1—Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen (b) Total weight (c) Av. Wt. per dozen (d) Total value from Pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
1	88	White Leghorn. Sister-in-Charge, R. D. E. School Swinford, Co. Mayo.	1941 Mar. 12	349	3 8	5 8	15	—	12	19	20	24	26	26	27	17	24	12	24	153	15	222	16	49 9¾	2 1	(a) 1,198	1	—	Oct.
			"	350	4 1	5 8	16	13	19	20	21	20	23	24	21	26	17	4	157	64	3	224	50	52 6¾	2 1	lb. oz. dr.	—	—	May, *May.*
			April 1	351	3 12	D	11	—	17	21	24	22	25	13	—	D	—	—	12	105	16	133	20	32 9¼	2 1	(b) 164 5 11	2	—	Oct., June, *May.*
			Mar. 12	352	3 11	4 8	19	3	15	22	10	16	21	12	22	16	8	5	16	127	5	178	41	42 1¼	2 2	(c) 2[illegible] 3 oz.	—	—	Nov., *July.*
			April 1	353	3 9	5 0	9	19	19	10	20	20	23	21	20	22	21	10	119	71	3	223	48	52 6½	2 4	(d) £14 2 0½	—	—	—
			Mar. 12	354	3 11	5 8	19	18	19	19	18	17	19	21	20	19	19	10	163	54	1	218	59	51 11½	2 5		—	—	—
2	90	White Leghorn. Miss M. Rafferty. Leitrim, Four-mile-House, Roscommon.	Jan. 3	361	3 10	5 0	19	19	13	14	23	23	28	24	25	23	22	11	88	149	2	239	50	55 9	2 3	(a) 1,234	—	—	—
			"	362	3 8	4 12	23	21	15	8	24	25	27	28	28	12	3	2	3	57	156	216	16	46 0¾	1 15	lb. oz. dr.	5	—	—
			"	363	4 0	D	21	22	d15	—	—	—	—	—	—	—	—	—	1	28	29	58	29	15 1	1 15	(b) 154 1 15	—	—	—
			"	364	3 9	4 12	20	17	14	—	21	22	23	24	22	24	23	10	120	99	1	220	50	50 6	2 3	(c) 25.2 oz.	—	—	Dec.
			"	365	3 12	5 6	21	23	19	21	20	21	23	23	19	21	22	10	21	209	13	243	60	57 8	2 1	(d) £13 11 6¼	—	—	—
			"	366	4 0	5 8	19	20	11	—	19	19	22	21	18	20	21	8	83	110	5	198	18	45 7	2 3		—	—	Dec.
*	95	White Leghorn. Mrs. M. O'Shea Farrantane, Castlegregory, Co. Kerry.	Feb. 19	373	3 8	3 10	8	3	19	20	19	21	24	24	24	23	20	10	2	106	107	215	25	46 9¼	1 15	(a) 1,150	1	—	Oct.
			Jan. 26	374	3 9	3 15	10	19	20	22	22	22	22	16	3	21	5	—	30	107	46	183	51	43 8½	2 1	lb. oz. dr.	—	—	—
			"	375	3 10	5 2	17	19	16	16	15	18	21	22	22	10	10	4	121	74	4	199	57	46 [illegible]	2 4	(b) 116 7 3	—	—	—
			"	376	3 8	4 3	11	—	7	21	21	20	24	19	22	21	19	8	1	118	74	193	16	42 [illegible]	2 0	(c) 24.5 oz.	2	—	Oct.
			"	377	3 6	4 0	13	13	10	—	11	20	22	22	21	21	16	7	2	79	98	179	28	37 5¼	1 15	(d) £12 10 9½	4	—	Dec.
			"	378	3 12	4 4	—	13	5	5	19	19	24	23	21	21	20	11	21	134	26	181	18	39 7¼	2 1		—	—	Oct.
*	86	White Leghorn. Mrs. W. Byrne, Kilcar, Curraghboy, Athlone, Co. Roscommon	Feb. 17	337	3 6	5 0	—	4	21	20	22	23	26	27	25	21	21	10	17	171	34	222	25	50 2¼	2 1	(a) 1,121	—	—	Oct.
			"	338	3 6	5 10	—	14	22	17	20	22	20	18	21	19	18	9	126	72	2	200	38	47 0½	2 4	lb. oz. dr.	—	—	Oct., *July.*
			"	339	3 4	3 10	—	10	2	17	18	20	22	23	19	21	1	—	1	88	64	153	7	38 0½	2 6	(b) 113 4 6	1	—	Oct., July.
			"	340	3 4	3 11	—	9	11	14	19	18	21	19	20	13	5	—	10	82	57	149	17	32 11	2 0	(c) 24.5 oz.	—	—	Oct., July.
			"	341	3 6	4 4	—	11	13	17	9	19	25	25	23	21	20	9	2	137	53	192	5	42 1	2 0	(d) £12 9 9½	1	—	Oct., *July.*
			"	342	3 8	5 4	—	—	21	22	22	20	25	23	25	20	21	6	2	99	104	205	17	44 6	2 0		2	—	Oct.
3	87	White Leghorn. Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.	Mar.	343	3 8	6 3	—	3	16	14	17	18	24	19	16	15	19	9	150	17	1	168	22	38 8	2 6	(a) 1,009	—	—	Oct., July, *June.*
			"	344	3 9	4 0	—	11	17	18	22	20	24	25	22	21	16	—	90	96	10	196	29	45 11	2 3	lb. oz. dr.	—	—	Oct.
			"	345	4 1	D	1	16	21	12	12	23	24	d10	—	—	—	—	77	40	2	119	20	29 4	2 1	(b) 145 12 11	—	—	Oct.
			"	346	3 12	5 3	—	—	3	13	12	20	15	23	19	18	21	8	145	7	—	152	7	23 10	2 6	(c) 27.7 oz.	—	—	Oct.
			"	347	3 8	5 6	—	5	20	14	18	22	26	21	23	21	7	8	147	38	—	185	25	42 5¼	2 6	(d) £11 14 0¾	—	—	Oct.
			"	348	3 12	5 6	10	4	19	21	21	27	24	17	15	12	16	6	131	49	6	189	33	41 7¼	2 5		—	—	Oct.

*Disqualified under Clause 26 (more than 20 per cent. second grade eggs). D = Dead.

SECTION V. —ANY NON-SITTING BREED.—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival (lb. oz.)	Weight: At close of Test (lb. oz.)	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet (s. d.)	Average Weight of Eggs per Pullet (oz. dr.)	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
4	89	White Leghorn. Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.	1941 March	355	3 11	5 0	3	11	18	—	13	20	20	20	18	21	17	9	109	59	2	170	32	38 7	2 5	(a) 969	1	—	Oct.
			,,	356	3 14	3 12	—	3	16	20	2	13	12	3	—	9	—	—	3	63	12	78	13	19 4¼	2 1	lb. oz. dr.	—	—	Oct
			,,	357	4 0	5 3	10	17	5	—	17	18	20	18	9	9	22	5	17	105	28	150	21	33 9¾	2 1	(b) 127 6 2	—	2	Oct.
			,,	358	3 14	5 6	19	13	21	17	13	23	23	23	22	18	16	3	41	153	17	211	43	49 4	2 2	(c) 25 2 oz.	1	—	—
			,,	359	3 9	4 3	20	2	20	21	21	23	21	21	22	20	16	10	7	141	69	217	12	49 8	2 0	(d) £11 2 7¼	4	—	Oct.
			,,	360	1 6	4 15	5	12	11	12	—	12	18	17	21	21	12	2	3	121	19	143	19	31 10¾	2 1		—	—	Jan., *Oct.*
†	91	White Leghorn. Mrs. M. A. Walsh, Wardstown, Athboy, Co. Meath.	April	367	3 12	5 12	3	24	20	9	22	23	23	23	18	22	18	8	48	146	19	213	32	49 4¾	2 2	(a) 935	—	—	Oct
			,,	368	3 13	5 14	—	13	15	16	19	20	21	23	23	17	17	6	176	13	1	190	28	43 10¾	2 6	lb. oz dr	—	—	Oct.
			,,	369	3 8	D	—	3	17	12	23	D	—	—	—	—	—	—	37	18	—	55	21	15 4½	2 4	(b) 126 4 13	—	—	Oct.
			,,	370	3 4	3 12	5	22	23	20	20	21	19	21	12	15	17	—	23	135	37	195	33	46* 3¼	2 1	(c) 25 9 oz.	1	—	Oct., June, ***May***.
			,,	371	3 6	4 11	—	—	15	7	21	22	24	13	18	14	18	—	9	64	79	152	6	33 0¼	2 0	(d) £10 17 3¾	3	1	Oct., June.
			,,	372	3 6	4 9	—	—	3	12	18	17	20	19	14	13	10	4	76	54	—	130	3	29 4¼	2 4		—	—	Oct
*	85	White Leghorn. Mrs. M. Hanly, Cooga, Doon, Co. Limerick.	Mar. 28	331	3 8	5 0	9	21	15	—	19	23	21	22	19	20	25	11	61	141	3	205	44	47 1	2 2	(a) 973	—	—	Oct.
			,,	332	3 13	D	—	—	—	—	2	—	D	—	—	—	—	—	2	—	—	2	—	6½	2 7	lb oz dr	—	—	Oct.
			,,	333	3 15	4 10	—	17	5	—	15	20	19	21	12	16	21	6	100	51	1	152	22	34 3¼	2 4	(b) 124 2 3	1	—	Oct.
			,,	334	3 6	4 3	11	14	10	2	23	23	25	23	23	20	24	12	—	59	151	210	2	43 11¼	1 11	(c) 21.5 oz.	3	—	Oct.
			,,	335	3 6	4 4	4	21	18	—	20	22	24	22	19	22	20	9	5	126	70	201	25	44 6	2 0	(d) £10 14 10	—	—	Oct.
			,,	336	3 6	4 8	3	20	16	7	22	24	24	20	18	22	18	9	5	81	117	203	9	44 5½	1 15		2	—	Oct

*Disqualified under Clause 26 (more than 20 per cent. second grade eggs). †Disqualified under Clause 26 (pen produced less than 960 eggs). D = Dead.

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED—7 PENS.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight On Arrival lb. oz.	Weight At close of Test lb. oz.	Eggs Laid Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 20	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen. (d) Total value from Pen.	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
1	72	Light Sussex. Sister-in-Charge,	1941 Feb.	409	5 9	6 4	—	11	21	21	15	19	23	23	22	20	20	9	188	16	—	204	36	47 5¼	2 5	(a) 1,230	1	—	Oct.
		St. Mary's Abbey,	,,	410	5 12	6 6	24	16	20	23	17	24	22	17	19	11	10	5	13	145	50	208	45	49 3¼	2 0	lb. oz. dr.	1	—	—
		Glencairn,	,,	411	5 13	5 8	20	16	22	22	22	20	21	19	15	10	11	7	130	75	—	205	63	49 11¼	2 4	(b) 161 15 3	—	—	Oct.
		Co. Waterford.	,,	412	5 15	6 10	19	22	24	23	21	21	21	19	20	23	20	12	7	165	73	245	45	47 0¼	2 0	(c) 25.7 oz	1	—	—
			,,	413	5 14	6 14	—	—	18	22	21	22	24	25	22	19	17	11	72	126	3	201	23	46 2¼	2 3	(d) £14 8 1¾	1	—	Oct.
			,,	414	5 8	6 8	—	17	12	2	24	22	18	19	19	13	15	6	19	112	6	167	28	38 2¼	2 2		—	—	Oct.
2	73	Light Sussex. Sister-in-Charge,	Feb. 21	379	5 6	6 3	5	24	7	9	24	21	26	16	10	17	15	7	6	110	65	181	24	40 9	2 0	(a) 1,113	—	2	Dec., July.
		St. Martha's College,	,,	380	5 9	6 0	20	19	18	20	23	21	21	26	24	20	20	9	170	71	—	241	62	56 11¼	2 4	lb. oz. dr.	—	—	—
		Slon, Navan.	,,	381	5 8	D	14	—	14	17	10	23	15	D3	—	—	—	—	13	75	8	96	32	24 3¼	2 2	(b) 149 4 9	1	—	Oct.
		Co. Meath.	Feb. 7	382	6 3	7 0	17	21	24	24	25	22	22	21	21	23	21	7	62	175	14	251	58	60 0¼	2 2	(c) 25.8 oz.	—	—	—
			Feb. 21	383	6 0	6 5	14	20	19	13	16	17	19	7	12	13	5	3	92	69	1	162	55	59 7¼	2 3	(d) £13 3 4¾	—	—	—
			Feb. 14	384	5 9	6 12	—	3	17	18	16	22	19	23	19	19	13	13	28	116	8	182	23	41 9¼	2 2		1	—	Oct., July
*	71	Light Sussex. Miss M. Daly,	Feb. 3	403	4 4	5 2	20	15	21	21	22	22	21	26	22	20	19	12	3	94	114	241	30	53 0¾	1 15	(a) 1,125	1	—	—
		Knockglass,	,,	404	4 13	5 6	22	20	21	22	19	16	18	7	5	6	6	—	2	123	37	162	50	40 4½	2 0	lb. oz. dr.	1	—	—
		Moynalty,	,,	405	3 13	4 12	16	15	20	18	18	20	7	11	14	17	10	—	96	64	6	166	52	40 10¼	2 3	(d) 142 4 5	1	—	Apl. July.
		Ceanannus Mor,	,,	406	4 8	6 2	9	22	22	2	22	22	21	21	24	15	15	8	3	178	42	223	45	52 3¼	2 0	(c) 24.3 oz.	1	1	*Oct.*
		Co. Meath.	,,	407	5 6	5 10	16	—	13	4	18	24	23	17	14	14	9	2	22	110	32	164	34	37 11¼	2 1	(d) £13 3 1	1	3	Nov., June.
			,,	408	4 6	5 2	1	19	19	16	22	19	23	23	12	13	—	2	—	79	90	169	19	35 0½	1 15		1	—	Oct., July
3	75	Barred Rock. Mrs. E. A. Henderson,	Feb. 10	421	5 9	7 8	—	8	13	—	20	22	26	18	21	12	9	3	131	27	—	158	21	35 4¾	2 5	(a) 1,100	1	—	Oct., July
		Ardrum,	,,	422	5 8	5 11	22	3	19	12	14	18	21	23	20	18	19	2	17	131	42	190	28	43 4½	2 1	lb. oz. dr.	—	1	—
		Inniscarra,	,,	423	5 11	7 4	15	26	13	—	17	26	25	25	24	26	23	11	16	180	35	231	14	51 7¼	2 1	(b) 148 11 11	—	—	Dec.
		Co. Cork.	,,	424	5 4	6 12	—	—	7	—	18	22	24	16	23	17	8	13	72	72	4	148	7	32 5½	2 3	(c) 25.7 oz.	—	1	Oct., July
			,,	425	5 0	7 0	—	5	11	7	19	20	25	22	24	22	20	10	121	63	1	185	15	41 3¼	2 4	(d) £12 9 10	—	—	Oct
			,,	426	5 8	5 11	23	19	19	13	10	14	24	20	22	11	12	10	11	160	26	197	47	45 8½	2 1		—	—	—
4	70	Light Sussex. Mrs. N. O'Sullivan,	Feb. 12	397	5 6	5 8	12	17	22	18	21	22	11	17	15	7	10	2	37	135	2	174	55	42 6¼	2 2	(a) 1,059	—	1	May
		Hill View,	Feb. 20	398	5 6	8 0	—	2	17	17	14	18	20	14	9	17	13	7	6	103	39	148	19	33 7¼	2 1	lb. oz. dr.	—	2	Oct., July.
		Bandon.	Feb. 12	399	5 9	5 9	22	7	8	19	21	21	22	25	13	16	14	11	67	128	4	199	40	46 7	2 3	(b) 144 3 10	—	1	Nov., *June.*
		Co. Cork.	,,	400	6 0	7 1	14	—	10	19	15	24	23	20	15	11	14	—	24	114	30	168	21	38 5¼	2 1	(c) 26.1 oz.	—	6	Nov., June
			,,	401	6 0	6 6	20	—	8	22	2	16	24	16	22	19	17	12	149	29	—	178	32	40 11¼	2 6	(d) £12 6 11¼	—	2	Oct., *May.*
			Jan. 26	402	4 10	12	18	2	11	21	19	22	24	22	19	16	16	2	137	51	1	192	36	41 10¼	2 4		—	—	Nov., July.

* Disqualified under Clause 26 (more than 20 per cent. second grade eggs). D = Dead.

SECTION VI.—ANY OTHER GENERAL PURPOSE BREED.—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching	No. of Pullet	Weight: On Arrival lb oz.	Weight: At close of Test lb oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 17	Mar. 18-Apl. 14	Apl. 15-May 12	May 13-June 9	June 10-July 7	July 8-Aug. 4	Aug. 5-Aug. 18	Eggs per Pullet: Special Grade	First Grade	Second Grade	Total	First Grade—Oct. 1—Dec. 29	Value per Pullet s. d.	Average Weight of Eggs per Pullet oz. dr.	(a) Total Eggs from Pen. (b) Total weight. (c) Av. Wt. per dozen (d) Total value from Pen	Eggs under Prescribed Weight	Number of times Broody	Date of Moulting (Neck moults in italics)
5	76	Buff Rock.	1941																										
		Mrs. A. Coleman,	Feb. 28	415	5 8	7 9	—	19	15	10	15	14	9	20	21	9	21	7	134	26	—	160	34	37 3¾	2 6	(a) 1,007	1	—	Oct.
		Ballycullen House,	„	416	5 4	7 8	—	12	18	24	14	20	19	17	1	—	20	1	145	1	—	146	35	38 10	2 8	lb. oz dr.	—	2	Oct., May.
		Croom,	„	417	4 8	7 1	—	—	15	19	18	19	25	23	19	18	17	8	104	77	—	181	20	41 6¼	2 4	(b) 153 7 7	—	—	Oct.
		Co. Limerick.	Mar. 14	418	5 0	6 2	—	11	12	4	21	21	21	26	23	19	17	10	184	1	—	185	23	41 8¼	2 9	(c) 29.3 oz.	—	—	Oct.
			„	419	4 14	6 10	—	6	16	17	23	20	26	15	19	14	3	11	161	9	—	170	24	39 7¼	2 7	(d) £11 13 2¼	—	2	Oct., July
			„	420	4 8	7 3	—	4	12	6	22	20	23	21	20	14	17	6	163	2	—	165	16	37 2¼	2 9		—	—	Oct.
*†	69	Light Sussex.																						s d	oz dr.				
		Mrs. M. Riordan,	Jan. 15	391	5 8	D	2	7	D4	—	—	—	—	—	—	—	—	—	4	8	1	13	12	3 6	2 1	(a) 891	—	—	Oct.
		Glenleigh,	„	392	6 0	5 10	22	24	7	6	23	25	27	27	22	12	10	—	9	129	67	205	37	46 0½	2 0	lb. oz. dr.	2	—	Dec., May, *July*.
		Clogheen,	Feb. 4	393	5 14	8 0	18	3	13	24	26	26	26	17	15	16	12	8	33	133	38	204	15	47 8¼	2 1	(b) 117 9 5	—	2	Nov., July
		Co. Tipperary.	Jan. 15	394	5 12	7 12	21	23	8	—	24	26	26	25	23	14	23	12	4	109	112	225	8	49 4¼	1 15	(c) 25.3 oz.	3	—	Dec., July.
			Feb. 4	395	5 13	7 11	—	20	8	—	23	14	21	5	14	17	11	6	77	50	12	139	27	31 11	2 3	(d) £10 2 7¼	—	3	Oct., *June*.
			Jan. 15	396	5 14	6 4	—	6	3	11	17	20	13	16	18	1	—	—	104	1	—	105	9	24 1½	2 10		—	4	Oct., June.

†Disqualified under Clause 26 (pen produced less than 960 eggs). *Disqualified under Clause 26 (more than 20 per cent. second grade eggs). D=Dead.

NOTES ON THE EMERGENCY POWERS (NO. 234) ORDER, 1942, RELATIVE TO

CULTIVATION OF LAND IN 1943.

1. The Emergency Powers (No. 234) Order, 1942, provides, subject to certain exceptions which are mentioned in paragraphs 10 and 11 of these Notes, that every occupier of five or more statute acres of arable land shall in 1943 cultivate, in accordance with proper methods of husbandry, an area equivalent to at least one-fourth of such land. In addition any occupier may be required to (a) carry out the whole or part of the necessary cultivation on a specified portion of his holding, (b) sow with wheat before a specified date the whole or part of the area required to be cultivated; or (c) sow with wheat a specified portion of the holding before a specified date.

2. The Order takes effect notwithstanding any covenant, agreement, condition or provision as to the user of the "holding" and no such covenant, etc., shall operate so as to penalise, impede or interfere with the cultivation required by the Order. Land let on the eleven months' system comes under the Order and the obligation to cultivate the requisite area in respect of such land lies on the person rated or liable to be rated for it, or, on such other person as is deemed also to be the occupier of the holding for the purposes of the Order as indicated in the following paragraph.

3. *Definition of Occupier.*—An occupier is defined as the person who is rated or liable to be rated in respect of the land. If, however, the person so rated or liable to be rated does not himself care and manage the land, then any person who is authorised to make lettings of the land on behalf of the actual occupier or (where no such authority exists) who cares and manages the land, is deemed, for the purposes of the Order, to be also the occupier.

4. *Definition of Holding.*—For the purposes of the Order an occupier's "holding" means all the arable land (i.e., land capable of being tilled) in his occupation in the State. If he has two or more farms he must cultivate at least one-fourth of the total area of arable land comprised in all the farms.

5. *Arable Land.*—"Arable" means capable of being tilled. Building lands, if arable, come, therefore, within the provisions of the Order as do also demesnes, save parts thereof on which timber would interfere with the cultivation or harvesting of crops.

6. *Non-arable Land.*—The following are examples of land which will

be regarded as non-arable and, therefore, not within the scope of the Order:—rough mountain grazing, unreclaimed bog, sand dunes, land regularly subject to flooding, land under timber, land recently planted for forestry purposes and land on which the cultivation and harvesting of crops would be interfered with by timber.

7. *Meaning of "Cultivation" or "Tillage."*—Cultivation or tillage comprises ploughing together with the subsequent operations necessary for the production and harvesting in 1943, in accordance with proper methods of husbandry, of the ordinary farm and garden tillage crops, i.e., cereals, potatoes, roots, vegetables and other green crops, as well as flax and tobacco. It should, however, be observed that, for the purposes of the Order (i) the growing of rape does not rank as cultivation; (ii) land sown with oats, barley or wheat, either alone or in conjunction with grass seed or with grass and clover seeds, will be held to be cultivated, but if it is sown with grass seed only or with grass and clover seeds only, it will not be regarded as cultivated, and (iii) first or second year's rotational grass, whether mown or grazed, does not rank as a cultivated crop. Apart from those limitations, the choice of crop to be grown on land cultivated in compliance with the requirements of the Order is left to the discretion of the occupier unless he is required to sow wheat as indicated in paragraph 1 of the Notes. Moreover, any part of a holding sown in 1942 with a Winter cereal for harvest in 1943 will be regarded as having been sown in 1943. An occupier will be liable to immediate prosecution after 15th July, 1943, if it is found that the required quota has not been tilled by that date.

8. *Nurseries and Orchards.*—Land used as nurseries for the propagation of fruit and forest trees or ornamental shrubs and bushes will be regarded as cultivated. Orchards, if properly planted and managed, will be regarded as cultivated.

9. *Conacre tillage and allotments.*—If an occupier arranges for the cultivation of his holding in 1943 either in conacre or by allotment holders such cultivation will, for the purposes of the Order, be regarded as cultivation by the occupier.

10. *Exceptions or exemptions.*—As indicated in paragraph 1 of these Notes the Order does not apply to a "holding" comprising less than five statute acres of arable land (see also paragraph 4 of these Notes). Neither does it apply to a "holding" which is or forms part of a public park, public recreation ground or an aerodrome.

11. *Permissive exceptions or exemptions.*—The Minister for Agriculture may, on the application of the occupier, declare a "holding" or a part thereof to be excepted from the provisions of the Order if he is satisfied that the entire "holding" or a part thereof.

(a) is required in the year 1943 for the purpose of carrying on of an

industry other than agriculture, and that its use for such purpose would be of greater service in national interests than its cultivation, or

(b) has been required and regularly used in the year 1942, and is required in the year 1943 for the accommodation, for periods not exceeding ten days at a time, of stock, intended for disposal at auctions, fairs or markets, or for shipment, or for the accommodation, as aforesaid, of stock held over from auctions, fairs or markets, or

(c) has been required and regularly used in the year 1942, and is required in the year 1943 for the accommodation of cattle or sheep intended for slaughter within fifteen days of their being accommodated on such holding, or

(d) has been required and regularly used in the year 1942, and is required in the year 1943 for the maintenance of a stud of high-class thoroughbred horses consisting of breeding animals, foals and yearlings, or

(e) has been regularly used in the year 1942 as the track of a racecourse or as a paddock, ring or other enclosure, adjacent to the stand or stands of a racecourse, and is required for that purpose in the year 1943, or

(f) has been required and regularly used in the year 1942 as a track for the training of racehorses by a trainer licensed as such by the Turf Club or the Irish National Hunt Steeplechase Committee, and is required for that purpose in the year 1943, or

(g) has been regularly used by an agricultural or industrial Society as their Show grounds, and is required for that purpose in the year 1943, or

(h) is let for the year 1943 to, or is owned by, a club, the main object of which is the promotion amongst its members of any outdoor game played between two or more persons, which is affiliated to or recognised by the governing body of that game in Ireland, and has been regularly used by such club for the playing of such game in the year 1942, and is required by such club for that purpose in the year 1943, or

(i) has been used by a college or school in the year 1942 as a playing field, and is required for that purpose in the year 1943.

12. *Application for declaration of exception.*—Applications for declaration of exception must be made not later than 1st December, 1942, on Form T.I.

which may be obtained from the Department. Where an applicant is a company, club or other association the application may be made by the Chairman, Secretary, or duly authorised agent. In many cases, lands used for industrial purposes or as an accommodation or butcher's paddock, a sports ground, playing field or show ground constitute the entire "holding" and comprise less than five statute acres of arable land. In such a case the lands do not come within the scope of the Order and no application for their exception is required. If, however, lands so used form only part of the "holding" or include five statute acres or more of arable land, a declaration of exception must be sought by the occupier if he desires relief from his obligation under the Order to till at least one-fourth of all the arable land in his occupation. The onus of proof that land should be excepted from the provisions of the Order lies on the occupier and he will not be relieved of his obligation to cultivate simply by the fact that he has made an application for exception.

13. *Lands not used for the purpose for which they were excepted.*—A declaration of exception is, of course, only valid in case the lands are used in 1943 for the purpose for which the declaration is granted. An occupier who obtains a declaration of exception in respect of all or a portion of his lands but who does not use them in 1943 for the purpose for which they were excepted must therefore till them, or till in respect of them, to the extent prescribed by the Order.

14. *Requirements of the Order in case part of a "holding" is excepted.*—If the Minister has declared that a portion of a "holding" comes within one or more of the exceptions set out in paragraph 11 of these Notes, the acreage to which the Order applies is the arable land comprised in the residue of the "holding." Thus, for example, a person occupying one hundred acres of arable land, of which thirty acres are excepted, would, for the purposes of the Order be regarded as occupying not more than seventy acres of arable land. If, after allowing for the excepted portion, the residue of arable land in the "holding" does not amount to at least five statute acres no part of the "holding" need be cultivated in order to comply with the requirements of the Order.

15 *Inspection of lands.*—Any person duly authorised by the Minister for Agriculture may, for the purposes of the Order, enter on and inspect any land or building and no one may lawfully obstruct or interfere with any person so authorised when carrying out such inspection.

16. *Penalties for non-compliance with the provisions of the Order.*—Failure on the part of an occupier to comply with the provisions of the Order constitutes an offence under the Emergency Powers Acts, 1939 to 1942, and renders him liable to prosecution and on conviction to a fine not exceeding £500 or imprisonment or to both fine and imprisonment.

Moreover, the Minister is authorised (a) to take immediate possession

of a holding which the occupier did not take reasonable steps to cultivate in 1942, or which was unoccupied in 1942; (b) to retain possession of a holding entered in 1942; (c) to retake possession of a holding which was entered in 1942 and has been surrendered to the occupier and (d) to take possession of any other holding on or after the 14th January, 1943, if he is satisfied that the occupier has not by that date taken reasonable steps to comply with the Order. The Minister may cultivate any holding of which he has taken possession or arrange for any person to do so on such conditions as the Minister may direct.

(Issued as Special Leaflet No. 24, November, 1942).

AGRICULTURAL STATISTICS—1942.

ACREAGE UNDER CROPS AND PASTURE AND NUMBERS OF LIVESTOCK ON 1st JUNE, 1942, WITH COMPARATIVE FIGURES FOR THE YEAR 1941

I.—ACREAGE UNDER CROPS AND PASTURE.

DESCRIPTION	1941	1942	INCREASE (+) OR DECREASE (—) IN 1942. Actual	Percentage
	acres	acres	acres	%
CORN CROPS :—				
Wheat ...	463,206	574,739	+ 111,533	+ 24.1
Oats . .	782,201	877,766	+ 95,565	+ 12.2
Barley ...	163,342	186,242	+ 22,900	+ 14.0
Rye	3,004	4,224	+ 1,220	+ 40.6
Beans and Peas . .	1,443	2,944	+ 1,501	+ 104.0
Total Corn Crops	1,413,196	1,645,915	+ 232,719	+ 16.5
ROOT AND GREEN CROPS :—				
Potatoes	428,146	425,501	— 2,645	— 0.6
Turnips .	156,986	146,427	— 10,559	— 6.7
Mangels .	95,974	83,601	— 12,373	— 12.9
Sugar Beet .	78,390	54,888	— 23,502	— 30.0
Cabbage .	17,316	16,505	— 811	— 4.7
Other Root and Green Crops	21,759	23,040	+ 1,281	+ 5.9
Total Root and Green Crops ...	798,571	749,962	— 48,609	— 6.1
FLAX . .	15,757	18,552	+ 2,795	+ 17.7
FRUIT ..	8,889	10,269	+ 1,380	+ 15.5
Total Corn, Root and Green Crops, Flax and Fruit	2,236,413	2,424,698	+ 188,285	+ 8.4
HAY :—				
1st Year's	273,066	289,694	+ 16,628	+ 6.1
2nd, 3rd, and 4th Years' ...	398,278	389,251	— 9,027	— 2.3
Permanent Meadow .	1,332,870	1,280,630	— 52,240	— 3.9
Total Hay	2,004,214	1,959,575	— 44,639	— 2.2
Total Crops	4,240,627	4,384,273	+ 143,646	+ 3.4
PASTURE	7,336,107	7,178,185	— 157,922	— 2.2
Total Crops and Pasture ..	11,576,734	11,562,458	— 14,276	— 0.1

II.—NUMBERS OF LIVE STOCK.

	No.	No.	No.	%
HORSES :—				
Stallions 2 years old and over	2,238	2,139	— 99	— 4.4
Broken Horses used for :—				
Agriculture .. .	346,411	348,613	+ 2,202	+ 0.6
Traffic and Manufactures	15,306	17,329	+ 2,023	+ 13.2
Amusements or Recreation	11,313	11,088	— 225	— 2.0
Unbroken Horses :—				
1 year old and upwards	52,680	46,384	— 6,296	— 12.0
Under 1 year .	31,228	26,494	— 4,734	— 15.2
Total Horses .	459,176	452,047	— 7,129	— 1.6
MULES AND JENNETS	8,438	8,232	— 206	— 2.4
ASSES	148,436	142,651	— 5,785	— 3.9
CATTLE :—				
Milch Cows . .	1,213,509	1,206,358	— 7,151	— 0.6
Heifers in Calf	95,237	93,703	— 1,534	— 1.6
Bulls . . .	27,727	25,060	— 2,667	— 9.6
Other Cattle :—				
3 years old and upwards	232,131	227,419	— 4,712	— 2.0
2 years old and under 3	670,873	637,587	— 33,286	— 5.0
1 year old and under 2 . ..	936,904	914,555	— 22,349	— 2.4
Under 1 year ..	974,079	978,943	+ 4,864	+ 0.5
Total Cattle .	4,150,460	4,083,625	— 66,835	— 1.6
SHEEP :—				
Ewes for Breeding	1,231,589	1,121,088	—110,501	— 9.0
Rams	45,390	39,320	— 6,070	— 13.4
Other Sheep :—				
1 year old and upwards	461,370	399,034	— 62,336	— 13.5
Under 1 year .	1,171,061	1,133,530	— 37,531	— 3.2
Total Sheep .	2,909,410	2,692,972	—216,438	— 7.4
PIGS :—				
Sows for Breeding	70,009	49,414	— 20,595	— 29.4
Boars . . .	1,584	1,239	— 345	— 21.8
Other Pigs :—				
6 months old and upwards .	62,457	37,919	— 24,538	— 39.3
3 months old and under 6 ...	271,167	182,626	— 88,541	— 32.7
Under 3 months	358,475	247,506	—110,969	— 31.0
Total Pigs	763,692	518,704	—244,988	— 32.1
POULTRY :—				
Turkeys	919,591	1,039,855	+ 120,264	+ 13.1
Geese	819,437	792,024	— 27,413	— 3.3
Ducks	1,254,969	1,049,215	—205,754	— 16.4
Ordinary Fowl	14,398,791	14,484,103	+ 85,312	+ 0.6
Total Poultry	17,392,788	17,365,197	— 27,591	— 0.2

INSECT PESTS AFFECTING FOOD PRODUCTION IN GARDEN AND ALLOTMENT.

Broadcast talk given by MR. J. CARROLL, D.Sc., Lecturer, University College, Dublin, on Saturday, 20th March, 1943.

In these times it is particularly desirable that everyone who owns a garden or allotment should endeavour to get the maximum yield from the various crops which he grows. There are many factors which influence the growth and health and yield of crops and the gardener or allotment owner who desires to obtain the best results from his labours must make himself acquainted, to some extent at least, with these various factors. In my talk this evening, I must confine myself to a brief discourse on the insect and allied pests which may be encountered in gardens and allotments and the effects which they may have on the crops usually grown.

Some of these pests attack the roots and other underground parts of plants. Others attack the plants just at soil level and still others attack the higher overground parts of plants. In each case damage of varying intensity may be caused—varying from slight damage in cases when the pests are few in number up to, perhaps total destruction, of the plants in cases where pests are very numerous.

The commonest pests which actually feed on the roots of miscellaneous garden plants are wireworms and millepedes. These pests can cause serious damage by eating away the roots of the plants, also they often invade potato tubers, carrots, parsnips, beetroot, turnips, etc., and by their burrowing in these often cause considerable loss. Other underground pests are the maggots of the cabbage root fly which burrow extensively in the roots of plants belonging to the cabbage family; the maggots of the carrot fly which burrow in carrots and parsnips and the maggots of the onion fly which burrow in the bulbous portion of the onion.

The commonest pests which cause damage by cutting plants at soil level are leather jacket grubs and surface caterpillars. The commonest pests which attack certain seedlings just as they are coming through the soil are flea beetles. The commonest pests which cause damage by attacking the higher overground portions of plants are leaf eating caterpillars and greenfly. Finally, I must not omit to make mention of slugs which may attack both the overground and underground portions of plants.

I will proceed to deal with the above pests in the order in which I have mentioned them.

Millepedes may be present in soil no matter how long it has been in

cultivation but wire worms will only be found to any extent during the first three or four years after ground has been broken up from grass to make a garden or allotment. Most people wish to know whether there are any materials which can be added to the soil to destroy these two pests. Unfortunately, there is not available any really efficient soil dressing which is moderately cheap. Contrary to the belief of many people such things as lime and agricultural salt are of little or no use in killing wireworms or millepedes. The best that can be recommended in the way of a soil dressing is Naphthalene and certainly, it is desirable to use this if wireworms or millepedes have been causing serious damage. The material should be applied at the rate of about 2 oz. per square yard of soil when it is being prepared in the spring to receive crops. It should be well dug in, and the soil should then be left for about two weeks before seeds are sown or a crop planted. Unfortunately, however, the price of Naphthalene has increased considerably since the war began but this factor may not deter some people from using it.

A useful way of reducing considerably the wireworm and millepede population in an area is to open shallow drills or ruts about 3 or 4 feet apart and then to scatter fairly thickly pieces of chopped up potatoes or turnips along the bottoms of these drills. These potatoes or turnips are then covered by pulling back some soil over them and the area is afterwards left undisturbed for a couple of weeks. During this time, numerous wireworms and millepedes will come to the potatoes or turnip pieces to feed and remain in them. After the couple of weeks the drills are re-opened and the pieces of bait in them picked out and destroyed, thus removing from the area a good proportion of the wireworms and millepedes.

The maggots of the carrot fly first attack the tip of the carrot root which they cut off. Later, they eat into the stouter part of the roots in all directions and sometimes cause a very great amount of injury or even complete death of the crop. A second generation of flies often emerges towards the end of the summer but generally, the greatest damage is caused by the spring generation.

If an attack of the carrot fly is feared it is usually advisable to postpone sowing the main crop of carrots until fairly late in the season, say about the middle or towards the end of May. Many of the flies will thus have already laid their eggs elsewhere before the plants come above ground. The operation of thinning and the loosening of the soil involved attracts the flies in greater numbers to the carrot beds. It is, therefore, advisable to thin the crop as little as possible, leaving the plants as close as two or three inches apart and firming down the soil well afterwards. As an additional precaution powdered or flake napthalene may be scattered between the rows of plants at, or before, thinning time so as to deter the flies from approaching. It is necessary however, to repeat this application two or three times after thinning, allowing an interval of a week to elapse

between each application. At each application the naphthalene should be applied at the rate of about 2 oz. per square yard.

In the case of the onion fly also the greatest damage is usually caused in the early part of the season while the onion plants are still quite small. The maggots bore into the onion bulbs, generally entering at the base. The substance of the bulb is eaten away and in a short time plants thus attacked commence to wither and die. Plants that have actually been invaded by the maggots cannot be saved so it is best to pull them up and burn them in order to prevent a later brood of the fly being produced. Small, weak, plants are more liable to be attacked than stronger ones and, therefore, everything that helps to produce strong, quickly growing, healthy plants is to be recommended; such as early sowing, a well prepared seed bed and suitable and adequate manuring. Scattering soot along the rows before the flies appear in the spring will help to keep them from laying their eggs near the plants and this should be repeated until the crop is out of danger. Naphthalene may also be used as a deterrant in the very same manner as recommended for the carrot fly.

The maggots of the Cabbage root fly first attack and usually destroy the smaller roots of such plants as cabbages, cauliflowers, etc. Later the main root is invaded and sometimes even the lower part of the stem. Severely attacked plants usually die but the stronger ones may produce a secondary root system and survive. If this pest has previously appeared in the garden, it may be better to sow the seed in the drills rather than to sow in a seed bed and later transplant. Thinning out of the seed thus sown in the drills should be done gradually and not completely at one operation, so as to leave a choice of plants in case some show signs of attack. If transplanting is done care should be taken to see that no plants with maggot infested roots are used. Naphthalene as a deterrent may be scattered around the plants at weekly intervals for two or three weeks after transplanting.

The leather jacket grubs are the larvae of daddy long legs flies and surface caterpillars are the larvae of certain moths. Both leather jacket grubs and surface caterpillars do the same type of damage, namely, they cut through such plants as cabbage, cauliflowers, lettuce, etc., just at soil level and this damage is invariably done during the night. These pests are relatively easy to control by scattering a poison bait for them. The normal bait is Paris green in bran but now since bran cannot be obtained flake oat meal can be used instead. Paris green can be obtained from a seedsmerchant and 1 oz. of the material should be mixed with 1½lb. of oatmeal. The mixture is then moistened slightly and scattered thinly in the evening time over the area where damage is being caused. It must be remembered that Paris green is very poisonous and must be used with care.

There are few insect pests of gardens which are so well known as

greenfly and leaf eating caterpillars. Green fly, if present at all, usually occurs in great numbers and greatly damage many kinds of vegetables by sucking the sap from the stems and leaves. Often much leaf curling and distortion is also produced. The best way to free plants from aphids is by spraying with a nicotine preparation. Many efficient nicotine preparations can now be bought and spraying should be done according to the directions on the container. When the black aphid occurs on the tips of broad beans, it is best to nip off the tips and destroy them

Plants of the cabbage family usually suffer most heavily from the attack of caterpillars but other vegetables may become infested with caterpillars also. The most efficient material for killing caterpillars on vegetables is a derris powder preparation Although derris is now becoming scarce on account of the war it is still possible to buy different proprietary brands of this material. For making a spray the derris preparation should be used according to the directions on the container, or as an alternative the dry powder may be tied into a piece of fine muslin and dusted dry through the muslin over the plants on which caterpillars are present.

Often seedlings of plants belonging to the cabbage family may be heavily attacked after they come through the ground by little jumping beetles. These beetles are known as flea beetles—a very well known one being the turnip flea beetle or turnip fly. The best recommendation that can be made if young seedlings are being attacked by flea beetles is to dust the seedlings with derris powder through a piece of muslin It is best to do this dusting in the early morning while the seedlings are damp.

It is hardly necessary to point out how destructive slugs and snails can be in the garden. The extent to which they can ruin the overground parts of plants by feeding on them is well known Also, slugs enter the soil and often cause great injury to potato tubers by burrowing in them. In order to reduce to a minimum the population of slugs and snails every effort should be made to eliminate as far as possible the sheltering places of these creatures in and around the garden or allotment. Slugs and snails are always most abundant in places where there are many heaps of rubbish, loose stones, edging plants, waste vegetation, etc. Under such shelters the pests can remain alive during the winter and they can also retire to such places each day during the time of the year when they are attacking plants. A good way to treat all waste places where slugs and snails may be sheltering is to spray such places with the solution made by dissolving ¼lb. of blue stone or copper sulphate in 12 to 15 gallons of water. This solution is most toxic to the slugs and snails but, as it would also kill vegetation it cannot be used where cultivated plants are growing. Adding lime or salt to the soil is of little or no avail against slugs or snails. When it was possible to purchase the substance known as Meta, a wonderfully effective poison bait for slugs and snails could be made from it but now Meta cannot be procured. The Paris green and oatmeal bait already recommended for

leather jacket grubs and surface caterpillars is also fairly efficient against slugs and snails and in cases where these pests are present such bait should be scattered about periodically.

Great numbers of slugs can be caught underneath pieces of turnip or potatoes if these are deposited here and there over the garden area. Such pieces of turnip or potato should be lifted frequently and all the slugs under them collected and destroyed. The best way to lessen the damage liable to be caused by slugs to potato tubers in the soil is to concentrate on killing as many slugs as possible at all times of the year on the surface of the ground. Pink skinned potatoes seem to be more favoured by slugs, and in gardens where slugs are plentiful such potatoes should be avoided. Also it is very desirable to dig potatoes as soon as possible after they have ripened because the longer they are allowed to remain in the soil the longer time will the slugs have to prey upon them.

MAKING AND BREAKING PASTURES

Broadcast talk given by PROFESSOR M. J. GORMAN, B.Sc., A.R.C.Sc.I. University College, Glasnevin, Dublin, on Saturday, 27th March, 1943.

In this crucial effort for food production our aim must naturally be to make every arable acre of our soil, work (and keep on working) to its full capacity. To produce high yields and go on producing them without at the same time impoverishing the soil calls for a considerable knowledge of the principles and considerable skill in the practice of good husbandry. This knowledge and this skill are more than ever necessary now during the period of the emergency through which we are passing, when supplies of several of the farmers' raw materials such as fertilisers are rather strictly limited. In the intensive campaign for extra tillage necessary to produce crops like potatoes, wheat, sugar beet, and oats for direct human consumption there is, perhaps, some danger that such matters as the value of pastures in contributing to our food supplies and their function in restoring and maintaining the fertility of our soils may receive less attention than they deserve. Farmers are well aware that lea land or ploughed up old pasture gives cleaner and better crops than land that has for several years been in tillage. The newly turned sod is richer in plant food materials. When it rots down it tills better and gives a nicer seed bed. Often it contains practically no tillage-crop weeds. By far the most important thing about it however, is its store of plant food materials—a store gradually accumulated while the land was under grass. An appreciation of this fact that plant food materials do accumulate in properly managed pastures is fundamental to the success of tillage farming and to the achievement of the highest output of food from all our soils. So we see that in the business of food production grass and tillage must be taken in close conjunction with one another and the value of our grasslands rests not merely on the fact that they produce directly for us beef, mutton, milk, butter and cheese. Actually, the greatest output of food and fodder is secured and the highest level of production is maintained when the so-called ley farming or mixed husbandry is practised, i.e., under a system of making and breaking grassland.

Under this system the pastures are broken before they have depreciated badly and ceased to become productive. A great deal of the grassland of this country has got into such a condition that it is no longer capable of giving a high or even a moderate yield of meat or milk. One has only to look at many of our pastures during the winter and early spring months to see the extent to which they have become over-run with Bent Grass. Bent Grass, unlike say Perennial Rye Grass which remains green in the winter, withers and turns white at the end of the season giving pastures in which it is abundant that whitish or greyish appearance during the early months of the year. Bent Grass as well as being unpalatable—it is not grazed off

by stock unless hunger compels them—is in any case a low yielding type. Its presence in quantity in a pasture is a sign of low fertility or bad grazing management. In the first case, i.e., where the fertility is low the better pasture types such as Perennial Rye Grass tend to die out quickly, no matter how careful the grazing, unless the necessary fertilisers are applied. On the better soils, the prevalence of Bent Grass on pastures is essentially due to grazing management. It will usually be found that where Bent is the dominant grass in good soils that there is a practice of grazing the pastures too hard in the early spring and undergrazing in the autumn. In the spring the Perennial Ryegrass which as is well known is the most important of our herbage grasses starts growth early and when starting suffers if grazed too hard. It receives a set-back from which it does not recover and thus year by year it is gradually weakened. The Bent Grass starts growth several weeks later (during May as compared with March for the Rye grass) when pasturage is more plentiful and so escapes excessively hard grazing. The fact that stock do not clean it off the pastures in the autumn also helps it to spread. In this case the Perennial Ryegrass is reduced partly as a result of hard spring grazing and partly as a result of competition by the Bent Grass.

Other pastures after a time become heavily infested with weeds such as Buttercup, Daisy, and Plantain and in consequence their productivity falls off. In fact in all pastures there is a more or less rapid replacement of the better herbage grasses and clovers by poor types of grasses and weeds. The poorer the soil the more rapidly the sown grasses and clovers die out.

When a pasture has got into this benty or weedy condition it may be a slow and difficult or even impossible matter to bring it back into a good sward by treatment. Often much may be done by manuring (especially with phosphate), top-dressings, controlled grazing, mowing to reduce tufts and prevent weeds seeding and harrowing to tear up mat and aerate. Generally speaking, however, the only satisfactory treatment for such pastures is ploughing and taking a rotation of crops, liming if necessary, giving in the course of the rotation liberal applications of farmyard manure and finally, laying down in the usual way with a carefully compounded seeds mixture. In certain circumstances it may not be convenient to take the rotation crops. The land may then be broken and re-seeded directly. So far, this practice is rather unusual and being still considered something of a novelty is apt to be regarded with suspicion. There have been some failures and disappointments with this method. They are most apt to arise from neglect to prepare the seed-bed properly. It must be fine and above all firm. If the ground is spongy the young grasses and clovers run a grave risk of dying from drought. This applies to all sowings of seeds no matter what method is being followed. Failures occur, too, when phosphate is lacking. It need hardly be said that no one would resort to the expense and trouble of ploughing up and re-seeding unless there was a good prospect of getting a greatly improved pasture. For that reason the method, which can only

be regarded as a rather drastic one, would not be adopted except in the case of pastures which have become very weedy and unproductive. When it comes to making a pasture whether it be a case of laying down at the end of a rotation or re-seeding directly after ploughing up, it must be borne in mind that provided the usual cultural operations of preparing seed bed, sowing, covering, rolling and so on are properly carried out success depends upon three things, viz., (1) the fertility of the seed bed; (2) the seeds mixture; (3) the management of the young pasture Taking the soil fertility first, i.e., the fertility of the ground in which the seeds mixture is sown, it need hardly be said that if the ground is poor, lacking in nitrogen, phosphate potash or lime or needs drainage, then it is no use expecting Ryegrass, Cocksfoot, Timothy or Clovers to grow vigorously and produce a heavy yield of hay or pasture. These pasture plants just like other farm crops will not thrive unless, they are suitably nourished. They are rightly described as fertility-demanders, they refuse to grow on poor soils, and they are driven out in a year or two by such competitors as Bent Grass, which have the advantage of being able to flourish quite happily even where the soil is very poor. It is, therefore, useless to sow expensive seeds mixtures on impoverished soils. Something must first be done to raise the fertility. If this is not done a sward of high quality cannot be expected.

As regards the seeds mixture the actual composition of this is determined chiefly by the duration of the ley—whether it be for one, two, three years, or more. As we are concerned on this occasion with pasture making and as pastures are very rarely laid down for periods of less than three years, the question of one and two years leys does not arise. The duration may be taken as being for three years or longer. It can be stated at once that there is no advantage in attempting to make distinctions between leys of say, three years and four years or three years and permanent pasture and attempting to make changes in the mixture accordingly. For a three years' ley, just as for a longer period, the longer-lived species and varieties of grasses and clovers must be selected. For pasture the ley species are Perennial Ryegrass and Wild White Clover. These are the two which are characteristic of all the best old pastures. Modern grassland research has shown that it is not necessary to sow many species in a permanent pasture mixture. Some years ago there were farmers who liked to sow in a mixture a dozen grasses and three or four kinds of clover. Nowadays, it is unusual to recommend more than four or maybe five grasses and two clovers and experience has shown that these simple mixtures are capable of producing swards of the highest quality. It cannot be too strongly emphasised that the success of the pasture both as a fodder-producer and as a fertility-builder depends on getting a good establishment of clovers. The Clovers are rich in proteins (always the most costly constituents of food) and in minerals. Besides, by means of the nodules or their roots—small roundish white swellings easily seen if clover plants are dug up and the roots examined—Clovers as a result of the activities of bacteria present in the nodules can draw upon the nitrogen of the air for their nutrition. The

nitrogen of the atmosphere is said to be fixed in this way. The clovers are therefore, independent of dressings of artificial nitrogenous manures such as sulphate of ammonia. Not only do the clovers fix enough of the nitrogen of the air for their own requirements but they even gather a surplus which escaping from the nodules into the soil enriches it so that even the grasses thrive better. Much of this nitrogen is stored and hence the fertility is built up.

The mixture of grass and clover seeds to be sown will depend somewhat upon local conditions and farmers must be guided by what they find out for themselves. The following mixture can be expected to give good results in very fertile and moderately fertile soils:

Italian Ryegrass	4 lbs.	per	statute	acre
Perennial Ryegrass	14	,,	,,	,,
Cocksfoot	6-8 lbs.		,,	,,
Timothy	5	,,	,,	,,
Late Flowering Red Clover	2-3	,,	,,	,,
Wild White Clover	½-1	,,	,,	,,

On poor light soils the Timothy should be omitted and 3 lbs. of Crested Dogstail included. When seed is available a useful addition for the better soils is 2 lb. of Rought Stalked meadow grass.

Italian Ryegrass lasts only one year or so and, therefore, it is undesirable to include a heavy seeding of it.

This mixture will not suffer seriously by having first crop hay taken provided the hay is cut early. It should be remembered that Wild White Clover must have light and, therefore, it is a great mistake to allow the after grass to grow up into a meadow. It should be grazed as soon as it is three or four inches high. As regards further management it has been found that the best way to keep the sward in good condition is to graze it and rest it alternately. What most of our pastures suffer from is over-grazing in the winter and spring and under-grazing in the summer.

In spite of the best management, however, the sward is apt to deteriorate and before this process has gone too far the pasture should be ploughed up.

Before concluding I might remind farmers that first crop grass will in 1944 count as compliance with the Tillage Order to the extent of not more than one quarter of the quota provided that tillage crops other than grass

are sown on the balance of the quota. It has been announced that the quota for 1944 will not be less than 1/3 or 33 1/3% of the arable land. Supposing, therefore, that a farmer's quota amounts to 24 acres in 1944 and he lays down this Spring six acres of grass seeds then next year 18 acres of other tillage crops will be sufficient to fill his quota. Finally, I might mention that in the Department's leaflet No. 42 the subject Laying down of Land to Hay and Pasture together with notes in the management of the sward is dealt with in much more detail than is possible in a short talk like this.

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WHEAT STORAGE TRIALS AT THE DEPARTMENT'S FARMS

Trials to determine the effect of different methods of storage on the germination of wheat were conducted at the Department's Agricultural Schools at Athenry, Ballyhaise and Clonakilty during the seasons 1941-42 and 1942-43.

In the autumn of 1941 an area of about 3 acres of wheat was selected for the trial at each centre. The crop on this area was divided into three lots, approximately equal, and as soon as the wheat was fit each lot was put into a single stack. The subsequent treatment of each lot was as follows :—

Lot I was threshed soon after harvest and the grain produce was divided into two sub-lots. One sub-lot was spread out on a loft to a depth of about 2 feet and turned weekly; the other sub-lot was stored in sacks. A representative sample was taken from each sub-lot immediately after threshing and thereafter at monthly intervals up to and including the month of April and forwarded to the Department's Seed Testing Station for germination test.

Lot II was allowed to remain in the stack for 9 to 10 weeks before being threshed. The stack was thatched. After threshing the sub-division and subsequent treatment of the produce was similar to that indicated in Lot I.

Lot III was also thatched and allowed to remain in the stack until the end of February or March before threshing was undertaken. After threshing the sub-division and subsequent treatment was similar to that in Lot I.

Particulars of the dates of cutting, stacking and threshing, together with the quantities of grain in each sub-lot are shown in Table I.

TABLE I.

Centre	Date of Cutting	Date of Stacking	Date of Threshing			Quantity of Grain					
			Lot I	Lot II	Lot III	Lot I		Lot II		Lot III	
						Floor	Sacks	Floor	Sacks	Floor	Sacks
						cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
Athenry	20th Aug.	10th Sept.	26th Sept.	13th Nov.	18th Feb.	9.50	7.00	10.50	8.50	8.00	6.50
Ballyhaise	15th Sept.	20th Sept.	26th Sept.	29th Nov.	25th Feb.	9.50	7.00	7.62	5.75	5.87	5.37
Clonakilty	25th Aug.	8th Sept.	16th Sept.	7th Nov.	28th Mar.	11.00	10.00	11.50	11.00	13.00	12.00

Varieties.

Queen Wilhelmina was the variety used at Ballyhaise and Clonakilty and Squarehead Master at Athenry.

Weather and Crop Conditions.

At all three centres the crop was fully ripe at the time of cutting. At Athenry, in the interval between cutting and stacking, the weather was very suitable for conditioning grain with the exception of two days on which rainfall was heavy. This did not have any injurious effect on the grain and the crop was in perfect condition at the time of stacking.

At Ballyhaise there was no rain for a fortnight before the date of cutting nor during the period in which the crop was in stooks.

At Clonakilty the weather at time of cutting was very wild and wet and the crop could not be stooked for three days. For a few days after stooking the weather was dull and misty but it improved early in September and the wheat was stacked in good condition on 8th September.

The results of the germination tests on the samples from the three centres are shown in Tables II, III and IV.

TABLE II.

ATHENRY SAMPLES—PERCENTAGE GERMINATION.

Month in which samples were taken	Lot I		Lot II		Lot III	
	Floor	Sacks	Floor	Sacks	Floor	Sacks
September ..	98	97	—	—	—	—
October ..	97	97	—	—	—	—
November ..	90	84	96	95	—	—
December ..	88	87	85	82	—	—
January ..	82	88	60	72	—	—
February ..	73	65	37	53	97	97
March ..	57	54	31	24	83	86
April ..	46	78	24	33	45	36

TABLE III.

BALLYHAISE SAMPLES—PERCENTAGE GERMINATION.

Month in which samples were taken	Lot I		Lot II		Lot III	
	Floor	Sacks	Floor	Sacks	Floor	Sacks
September ..	74	80	—	—	—	—
October ..	71	73	—	—	—	—
November ..	67	68	76	83	—	—
December ..	58	70	71	74	—	—
January ..	52	59	50	67	—	—
February ..	62	55	46	66	88	91
March ..	53	53	40	45	78	73
April ..	51	53	40	47	72	81

TABLE IV.

CLONAKILTY SAMPLES—PERCENTAGE GERMINATION.

Month in which samples were taken	Lot I		Lot II		Lot III	
	Floor	Sacks	Floor	Sacks	Floor	Sacks
September	91	92	—	—	—	—
October ..	89	83	—	—	—	—
November ..	75	75	88	85	—	—
December ..	75	65	78	79	—	—
January ..	67	63	76	64	—	—
February ..	65	51	67	64	—	—
March ..	61	50	62	60	88	95
April ..	60	45	65	61	87	84

The results set out in Tables II, III and IV show that:

(*a*) the initial germination results for Lots I, II and III do not vary to any appreciable extent, thus indicating that the germination of wheat can be maintained at a high level by keeping the grain in the stack until shortly before it is required for seed;

(*b*) there was no very marked difference at any centre in germination from grain spread on the floor as compared with that kept in sacks;

(*c*) subsequent to threshing the germinating capacity of the grain (both on floor and in sacks) deteriorated in Lots I, II and III at all centres. Except at Clonakilty, the germination of the wheat in Lot II deteriorated more rapidly and had reached a lower level at the termination of the trial than the wheat in Lot I. This is contrary to what might be expected since Lot II was kept in the stack for several weeks after Lot I had been threshed. Lot II should, therefore, be better matured than Lot I and might reasonably be expected to maintain its germination at a higher level than Lot I. Indeed the results for Lot II and Lot III, while showing that the germination was maintained at a high level up to the time of threshing, do not furnish any evidence that the length of time the wheat was kept in the stack had any beneficial effect on the trend of germination during the period of storage subsequent to threshing.

The Athenry results which are set out in Table II show a sharp fall in the germination of the February samples in Lot II as compared with the previous month. At this centre also, the April samples from Lot III showed a very steep fall in germination compared with the figures for the preceding month. When these results became known duplicate samples were obtained for a check test. The results from this were: sample from floor 27 per cent.; sample from sacks 21 per cent.; thus showing that the germination of Lot III continued to depreciate rapidly.

RESULTS IN 1942-43 SEASON

A trial on somewhat similar lines to that conducted in 1941-42 was again carried out at the Department's Schools during the season 1942-43.

A uniform crop of wheat was selected for the trial at each centre. When the crop was ready for stacking, the produce of three to four statute acres was divided into three approximately equal lots and stacked. At the time of stacking a representative sample of grain was taken and tested for dry matter. The sample was obtained by taking a handful of ears from at least thirty stooks selected at random in each lot.

Subsequent to stacking, the treatment of each lot was as follows :—

Lot I : This lot was threshed soon after stacking. After threshing the produce was divided into three sub-lots approximately equal and treated as follows :—

Sub-lot (a) : stored in untied sacks ;

Sub-lot (b) : spread out on the floor to a depth of about 2½′ and turned at fortnightly intervals on a dry day ;

Sub-lot (c) : the grain was mixed with a quantity of chaff corresponding with the original chaff content and spread out on the floor to a depth of 2½′ and turned at fortnightly intervals.

Immediately after threshing, representative samples were taken from each sub-lot. These samples were tested for germination and moisture content. These tests were carried out at the Schools and were repeated at fortnightly intervals up to about the end of April.

Lot II : The stack comprising this lot was thatched and allowed to stand for about nine weeks from the date of stacking before threshing was undertaken. The sub-division, subsequent treatment and tests were as indicated for Lot I.

Lot III : The stack comprising this lot was thatched and allowed to stand until the end of February or early in March when threshing was carried out. The sub-division, subsequent treatment and tests were as indicated for Lot I.

A record was kept of the relative humidity at each centre throughout the experimental period.

Clonakilty Centre

The experiment was carried out at this centre with the variety Diamant. The area used was 3¼ statute acres. The weather during harvesting was fine but afterwards there was a considerable amount of rain. The stooks were turned a few times and when stacked on 4th September, 1942, the wheat was in a dry condition. At the time of stacking, the average moisture content of the grain was 18 per cent.

Subsequent to stacking, the different lots were treated as described above. The dates of threshing and the quantities of grain in each sub-lot are shown in Table I :—

TABLE I.

	Date of Threshing	Quantity of Grain in each sub-lot		
		(*a*)	(*b*)	(*c*)
		c. q.	c. q.	c. q.
Lot I	5th September, 1942	7 0	5 3	5 1
Lot II	6th November, 1942	8 2	6 3	7 0
Lot III	12th March, 1943	6 0	6 1	6 2

The relative humidity, moisture content and percentage germination in respect of each date of sampling are shown in Table II.

The figures for relative humidity set out in Table II and subsequent Tables are the average of the relative humidity for the day of sampling and for the two previous days. It was considered that if there is any association between relative humidity and germination, these figures would be more appropriate than the average relative humidity for the inter-sampling period. Comparing the figures for relative humidity and germination in the case of Lot I, it will be seen that as relative humidity decreased so also did the percentage germination, and at first sight it would appear that relative humidity and germination are positively correlated. It is apparent, however, that such association as exists between the data is merely a coincidence and of no value as a possible explanation for the downward trend in germination, the reason being that once a proportion of the grain has died it cannot recover and show an improvement in germination when the relative humidity decreases with the approach of spring.

It will be observed from the results set out in Table II that the germination of the grain was maintained at a high level in the stacks, since in the case of Lot II and Lot III the germination in all sub-lots was high for several weeks subsequent to threshing. In the case of Lot I, the initial germination in all sub-lots was somewhat low and by late spring had deteriorated to a considerable extent. The fall in germination was not, however, regular and consistent. For instance, in the case of Lot I (sub-lot (*a*)), the germination had fallen to 66 per cent. on 11th January, 1943, while a sample from the same sub-lot germinated 78 per cent. on 8th February, *i.e.*, the germination showed an increase of 12 per cent. between these dates. Such variation must be due to :—

(*a*) Sampling ;

(*b*) Delayed germination ; or

(*c*) A combination of both causes,

TABLE II.

Clonakilty Results :

	Date of Sampling	Relative Humidity	Germination per cent.			Moisture Content per cent.		
			(a)	(b)	(c)	(a)	(b)	(c)
LOT I	21st Sept. '42	80	82	91	88	18.4	18.0	18.0
	5th Oct. ,,	79	80	90	85	18.8	19.6	19.6
	19th ,, ,,	92	87	82	83	19.4	19.2	19.0
	2nd Nov. ,,	76	79	73	72	18.4	19.0	18.8
	16th ,, ,,	84	85	87	87	19.2	19.0	19.2
	30th ,, ,,	84	81	82	89	19.2	19.0	19.4
	14th Dec. ,,	88	77	76	80	19.4	19.4	19.0
	28th ,, ,,	93	71	74	71	19.4	19.2	19.0
	11th Jan., '43	93	66	77	74	19.0	19.0	18.8
	25th ,, ,,	93	74	73	74	18.8	19.0	19.0
	8th Feb. ,,	90	78	71	73	18.9	19.0	19.1
	22nd ,, ,,	85	64	68	73	19.0	19.1	19.0
	8th Mar. ,,	85	71	66	67	19.2	19.0	18.8
	22nd ,, ,,	87	74	64	61	19.0	19.0	19.4
	5th April ,,	82	52	58	56	19.0	19.1	19.0
	19th ,, ,,	81	51	52	49	18.6	18.9	18.5
	3rd May ,,	57	61	61	63	18.4	18.4	18.0
LOT II	16th Nov. '42	84	99	97	95	19.2	19.4	19.5
	30th ,, ,,	84	99	99	97	18.8	19.2	19.4
	14th Dec. ,,	88	98	99	97	18.9	19.5	19.4
	28th ,, ,,	93	99	97	94	19.4	19.8	19.4
	11th Jan. '43	93	99	97	98	19.0	19.4	19.4
	25th ,, ,,	93	97	94	94	18.8	19.2	19.5
	8th Feb. ,,	90	95	92	94	18.8	19.1	19.3
	22nd ,, ,,	85	92	89	89	18.8	19.2	19.1
	8th Mar. ,,	85	90	81	87	18.9	19.0	19.2
	22nd ,, ,,	87	88	80	82	18.9	19.2	19.0
	5th April ,,	82	73	71	73	18.8	19.0	19.0
	19th ,, ,,	81	75	68	73	18.6	19.0	18.8
	3rd May ,,	57	71	75	73	18.5	19.0	18.4
LOT III	22nd Mar. '43	87	97	96	95	18.5	18.6	18.8
	5th April ,,	82	96	90	97	18.4	18.6	18.4
	19th ,, ,,	81	95	93	94	18.2	18.1	18.0
	3rd May ,,	57	96	94	98	18.0	18.2	18.2

for it is certain that if 34 per cent. of the grain was dead on the 11th January, it would not be possible to obtain a germination of 78 per cent. on 8th February.

In the case of Lot II, the germination of all sub-lots did not commence to deteriorate until about twelve weeks after threshing. When deterioration set in, it continued until the end of the experiment, by which time the germination had fallen to the region of 70 per cent. It is difficult to account

for this decline in germination which set in about ten to twelve weeks after threshing in all sub-lots of both Lot I and Lot II. The moisture content of the samples does not provide a sufficient explanation. Indeed, the figures for the moisture content of the grain showed comparatively little variation throughout the experimental period at the Clonakilty centre.

In the case of Lot III, no deterioration occurred in any of the sub-lots from the time of threshing to the conclusion of the experiment.

The different methods of storage (*a*), (*b*) or (*c*) did not appear to have any effect on germination, and in general, the grain stored in sacks maintained its germination as well as that kept on the floor and also as well as lot (*c*) which was mixed with chaff.

Ballyhaise Centre

The experiment was carried out at this centre with the variety, April Red. The wheat was cut on the 7th September and stacked on the 6th October. On the date of stacking, the average moisture content of the grain was 20.2 per cent.

The weather, prior to cutting, was very wet and continued wet while the crop was in stook. The dates of threshing and the quantities of grain in each sub-lot are set out in Table III :—

TABLE III.

	Date of Threshing	Quantity of Grain in each Sub-lot		
		(*a*)	(*b*)	(*c*)
		c. q.	c. q.	c. q.
Lot I	27th October, 1942	6 2	6 2	7 0
Lot II	22nd December, 1942	5 0	5 2	6 0
Lot III	22nd February, 1943	5 1	6 0	5 0

The data for relative humidity, percentage germination and moisture content are shown in Table IV.

The germination results obtained at Ballyhaise are somewhat similar to those obtained at Clonakilty. As at Clonakilty, the germination of the grain was maintained at a high level in the stack up to the time of threshing and for five or six weeks thereafter. Subsequently, the germination of both Lots I and II showed a fairly steady decline and by the end of April it had fallen to the region of 70 per cent. The germination results for Lot III also showed a slight tendency to decline towards the end of the experiment.

TABLE IV.

Ballyhaise Results :

	Date of Sampling	Relative Humidity	Germination per cent.			Moisture Content per cent.		
			(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)
LOT I.	27th Oct. '42	74	95	95	95	19.7	19.7	19.7
	10th Nov. ,,	93	92	92	92	18.4	18.5	18.5
	24th ,, ,,	93	92	91	90	18.4	18.5	18.7
	8th Dec. ,,	96	91	90	90	18.6	16.5	18.5
	22nd ,, ,,	93	90	91	89	17.1	16.1	17.1
	5th Jan. '43	94	89	85	87	18.4	17.3	19.0
	10th ,, ,,	100	88	83	85	16.1	18.9	18.3
	24th ,, ,,	67	88	87	84	17.8	17.2	17.9
	27th ,, ,,	71	92	94	85	17.5	17.4	17.6
	9th Feb. ,,	69	86	90	84	18.0	17.3	17.1
	22nd ,, ,,	66	88	83	82	17.4	17.4	17.4
	27th ,, ,,	64	87	80	78	17.2	17.6	17.6
	15th Mar. ,,	69	88	78	71	17.6	16.7	16.4
	31st ,, ,,	73	86	73	70	17.4	17.0	16.3
	13th April ,,	70	78	70	69	17.4	16.2	16.4
	27th ,, ,,	76	74	69	63	17.4	16.5	15.8
LOT II	22nd Dec. '42	95	92	93	95	19.3	19.4	18.3
	10th Jan. '43	100	92	90	92	18.4	18.3	19.4
	24th ,, ,,	67	96	94	93	18.3	18.9	18.9
	27th ,, ,,	71	94	92	90	18.3	18.8	18.5
	9th Feb. ,,	69	87	92	90	18.6	18.4	17.9
	22nd ,, ,,	66	87	84	87	17.1	18.6	17.1
	27th ,, ,,	64	88	82	85	17.8	17.2	17.6
	15th Mar. ,,	69	88	80	81	17.2	17.0	16.7
	31st ,, ,,	73	87	75	76	17.5	17.3	16.4
	13th April ,,	70	82	73	78	15.2	17.1	16.4
	27th ,, ,,	76	78	70	72	15.5	17.4	16.6
LOT III	22nd Feb. '43	66	95	88	94	14.9	16.5	15.7
	27th ,, ,,	64	84	87	90	16.6	16.6	15.8
	15th Mar. ,,	69	90	85	89	15.0	15.9	16.4
	31st ,, ,,	73	90	84	87	15.8	16.6	14.9
	13th April ,,	70	91	87	94	16.0	16.2	16.8
	30th ,, ,,	62	86	84	88	16.2	17.3	16.0

The figures for germination do not show a continuous decline throughout. For instance, in the case of Lot I (sub-lot (*b*)) the germination on 10th January, 1943, was 83 per cent. whereas on the 27th January, the germination had increased to 94 per cent. Similar irregularity has already been referred to in the Clonakilty results. In this case it is interesting to note that the improvement in germination coincided with a sharp fall in the relative humidity and also with a fall in the moisture content from 18.9 per cent. to 17.4 per cent. During this period, sub-lot (*a*) showed an increase of 4 per cent. in germination while there was no change in the case of sub-lot (*c*).

The behaviour of sub-lot (*b*) may perhaps be associated with the position of the grain on the loft. This sub-lot may have been in a better drying position on the loft than the other sub-lots.

The different methods of storage to which sub-lots (*a*), (*b*) and (*c*) were subjected had little effect on germination. From the end of February onwards, however, the germination of sub-lots (*b*) and (*c*) declined somewhat more rapidly than that of sub-lot (*a*) which was stored in sacks. This occurred in both Lot I and Lot II.

The figures for moisture content at this centre show considerable variation over the period of storage. In general, the moisture content of the different sub-lots of Lot I and Lot II decreased progressively during the spring months. Indeed, some of the samples had a remarkably low moisture content. For example, the moisture content of Lot II (sub-lot (*a*)) fell from 19.3 per cent. on 22nd December to 15.2 per cent. on 13th April. The data indicates, as might be expected, that the moisture content is associated with the relative humidity.

Athenry Centre

At this centre the experiment was conducted with the variety, Squarehead Master. There was no lodging in the plot and ripening was even. The crop was cut on 24th August and was then fully ripe. Broken weather occurred during harvesting but as a result of careful handling the quality of the grain was not impaired. The wheat was stacked on the 11th September. The average moisture content of the grain at time of stacking was 18.5 per cent.

The dates of threshing and the quantities of grain in each sub-lot are shown in Table V :—

TABLE V.

	Date of Threshing	Quantity of Grain in each Sub-lot		
		(*a*)	(*b*)	(*c*)
		c. q.	c. q.	c. q.
Lot I	2nd October, 1942	5 1	5 3	5 3
Lot II	20th November, 1942	5 0	6 3	6 3
Lot III	23rd February, 1943	2 3	5 1	5 1

The data for relative humidity, percentage germination and moisture content are set out in Table VI.

It will be observed from the results set out in Table VI that the germination of the grain was maintained at a high level during the period of storage

TABLE VI.

Athenry Results.

	Date of Sampling	Relative Humidity	Germination per cent.			Moisture Content per cent.		
			(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)
	2nd Oct. '42	79	96	95	96	15.7	16.1	16.2
	16th ,, ,,	95	93	98	96	18.2	17.5	16.9
	30th ,, ,,	96	72	91	86	16.5	16.1	15.7
	13th Nov. ,,	97	76	89	86	17.0	16.0	16.5
	27th ,, ,,	94	75	91	86	18.3	17.5	17.5
	11th Dec. ,,	93	79	67	75	18.2	18.1	17.8
	24th ,, ,,	94	62	67	69	18.8	17.5	18.0
LOT I	8th Jan. '43	94	59	60	70	18.5	17.5	17.6
	22nd ,, ,,	94	51	53	69	18.4	17.8	18.0
	5th Feb. ,,	95	36	38	33	18.7	18.0	18.5
	19th ,, ,,	93	36	26	39	18.7	18.0	18.3
	5th Mar. ,,	88	29	26	31	18.0	17.3	17.7
	19th ,, ,,	89	23	23	25	18.0	17.4	17.8
	2nd April ,,	90	16	29	17	17.7	17.2	17.5
	16th ,, ,,	92	22	31	20	17.8	17.0	16.1
	20th Nov. '42	94	94	90	95	18.5	17.7	17.1
	27th ,, ,,	94	91	78	88	19.2	19.0	18.3
	11th Dec. ,,	93	73	75	76	18.9	19.0	18.0
	24th ,, ,,	94	73	77	73	19.2	18.9	17.9
	8th Jan. '43	94	69	69	70	19.0	18.6	18.0
LOT II	22nd ,, ,,	94	59	43	59	18.3	18.5	17.7
	5th Feb. ,,	95	37	15	31	19.3	19.0	18.0
	19th ,, ,,	93	29	12	21	19.3	19.2	18.0
	5th Mar. ,,	88	16	7	13	18.0	17.3	17.1
	19th ,, ,,	89	12	6	7	19.0	17.6	17.5
	2nd April ,,	90	15	7	4	18.8.	17.5	17.0
	16th ,, ,,	92	6	7	4	18.7	17.6	16.6
	23rd Feb. '43	91	92	93	93	16.5	18.0	17.5
	5th Mar. ,,	88	89	91	92	16.5	17.9	17.6
LOT III	19th ,, ,,	89	71	77	80	17.0	17.5	17.4
	2nd April ,,	90	66	45	53	17.1	17.2	17.0
	16th ,, ,,	92	46	19	31	16.9	16.8	16.4

in the stack and that the germination for all lots and sub-lots fell off rapidly throughout the period of storage on the loft. Contrary to what might be expected, the falling-off in germination was more rapid in Lot III than in the lots which were threshed earlier. When sub-lots (*a*), (*b*) and (*c*) are compared, it is evident that the different methods of storage had no appreciable effect on germination.

The figures for moisture content obtained at this centre are in general comparatively low. Indeed, the moisture content of the first samples for Lot I was remarkably low. Equally remarkable is the extent to which the

grain absorbed moisture. For instance, the sample taken from Lot I (sub-lot (*a*)) on 2nd October had a moisture content of only 15.7 per cent. while on 24th December a sample from the same material gave a moisture content of 18.8 per cent., *i.e.*, an increase of 3.1 per cent. The figures for moisture content obtained at Athenry have been somewhat lower than those obtained at Clonakilty, and it is difficult to understand the very marked decline in germination experienced at Athenry in view of the figures for moisture content. On the other hand, the figures for relative humidity at Athenry have been consistently high throughout the entire experimental period. From the data available, the high relative humidity experienced at Athenry appears to be the only explanation for the very marked decline in germination which occurred in all lots at this centre.

SUMMARY.

As these trials are being continued it would be imprudent to arrive at any definite conclusions from the results obtained during the past two seasons, nevertheless, these results indicate that :—

(1) The initial germination results for all lots were satisfactory and did not vary to any appreciable extent, thus indicating that the germination of wheat can be maintained at a high level by keeping the grain in the stack until shortly before it is required for seed;

(2) There was no very marked difference at any centre in the germination from grain :

- (*a*) stored in sacks;
- (*b*) spread on floor to a depth of about $2\frac{1}{2}'$; and
- (*c*) spread on floor to a similar depth mixed with chaff.

(3) In the 1941-42 season the germination for all lots deteriorated after threshing at all centres, the greatest decline occurring at the Athenry centre.

(4) Subsequent to threshing, the germinating capacity of the grain deteriorated in the 1942-43 season at all centres in Lots I and II and also in the case of Lot III at Athenry. The greatest decline occurred at the Athenry centre where the relative humidity remained at a high level throughout the experimental period. The germination in respect of Lot III did not deteriorate at Clonakilty and deteriorated

only to a slight extent at Ballyhaise, while at Athenry the germination for Lot III fell very rapidly. The period of storage in the case of Lot III was characterised by a comparatively low relative humidity at Ballyhaise and Clonakilty and by a high relative humidity at Athenry. Consequently, it would appear that high relative humidity at Athenry may have been responsible for the rapid decline in germination which occurred at that centre.

(5) In general, the length of time the wheat was kept in the stack appeared to have little effect in preventing a decline in germination subsequent to threshing.

ARTIFICIAL FARMYARD MANURE

BY

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The great increase in the area under tillage in this country occasioned by the existing emergency has created a growing demand for fertilizers to maintain soil fertility. Under present conditions, however, the supply of artificial manures has been strictly limited to small amounts for specified crops so that many farmers are almost entirely dependent upon farmyard manure for the maintenance of crop productivity.

As is well known, well-made farmyard manure is a valuable fertilizer containing Nitrogen, Phosphoric Acid and Potash in a form that can be fairly readily assimilated by plants. In addition, its application to the land has marked beneficial effects on the physical properties of soils. The analysis of farmyard manure is variable, depending upon the kind of stock from which it was produced, the foods fed, the litter used and the subsequent storage. On the average, however, ten tons of well-made farmyard manure should contain about the equivalent of 5 cwt. of Sulphate of Ammonia, 4 cwt. of Superphosphate and 2 cwt. of Muriate of Potash. With adequate supplies of farmyard manure, therefore, the general level of productivity of crops should not be lowered.

It is not easy, however, under existing conditions, to increase the supplies of farmyard manure to meet current demands, particularly on farms hitherto devoted to the outwintering of cattle and where no suitable housing for live stock is available for inwintering; even where suitable accommodation is available the number of animals inwintered is limited by the amount of food available for livestock feeding.

Formerly, scarcity of litter was a limiting factor in the production of farmyard manure, but with the extension of the area under wheat and other cereals an abundance of straw is now available on most farms which, in many cases, is far in excess of requirements both for feeding and littering.

This straw, although not usually regarded as a fertilizer in its natural state, contains Nitrogen, Phosphoric Acid and Potash, as may be seen from the following Table of analysis :—

TABLE I.

Composition of Cereal Straws.

	Nitrogen	Phosphoric Acid	Potash
	per cent.	per cent.	per cent.
Wheat	0.48	0.25	0.90
Oats	0.72	0.19	1.20
Barley	0.57	0.26	1.20

These constituents, however, are not directly available as a plant food; in fact, it is now realised that if straw is ploughed direct into the soil without previous rotting its effect on fertility would be negative, experiments having shown that this practice would actually have a depressing effect on the yield of crops for at least the first year after application. During the process of decomposition of straw in the soil, nitrogen in the soil is actually immobilized. It is essential, therefore, that straw should be decomposed before it is incorporated with the soil.

It is not easy, however, to bring about the decomposition of a large bulk of dry straw owing to the difficulty in wetting it and also to its cellulose nature. To get over this difficulty experimental work has been carried out from which a technique has been evolved for the production of "artificial farmyard manure" from straw, resulting in a product closely resembling farmyard manure.

The success of these processes, however, was dependent on (1) having the straw thoroughly wet, (2) the presence of a nitrogenous compound and (3) the presence of a base to correct excess acidity; the addition of a little phosphate was also said to be beneficial.

The source of nitrogen used in these processes was either Sulphate of Ammonia, Calcium Cyanimide or a proprietary compound known as "Adco," none of which is obtainable in this country at present. Consequently, attention has been directed to other ways of bringing about the decomposition of straw using raw materials available to farmers.

At least some live stock must be kept on all farms as, for instance, horses for farm work, cows to supply milk for the farmer's household, calves from these cows, and perhaps, a few pigs also; it is possible, therefore, to collect the solid and liquid excreta from these animals. Consequently, it was decided to enquire into the possibility of using the solid and liquid excreta of farm animals as "accelerators" in the decomposition of straw since both of these products contain nitrogen and the bacteria which cause decomposition.

As already pointed out, the wetting of straw preparatory to decomposition, is of the utmost importance, and in these experiments some difficulty was at first experienced in this connection. The straw had been spread out on the ground and repeatedly sprinkled with water but it was found that it was very difficult to get the straw adequately wet and that this method of wetting was exceptionally slow. To expedite the process of wetting, therefore, it was decided to use a low concrete tank, which was available at the time, in which the straw could be immersed in the liquid used for wetting and this was quite successful in speeding up the process.

In the following preliminary experiments different methods were used in an endeavour to bring about the decomposition of the straw.

1. Straw wetted with water + fresh stable manure.
2. ,, ,, ,, ,, + ,, ,, ,, + Clare Phosphate.
3. ,, ,, ,, dilute liquid manure, + ,, ,,
4. ,, ,, ,, ,, ,, ,, + fresh stable manure.
5. ,, ,, ,, ,, ,, ,, + ,, ,, ,,
   + Clare Phosphate.

It will be seen that fresh stable manure, dilute liquid manure, and both together were used as "accelerators." The stable manure, which consisted mainly of the solid excreta of horses, was used in preference to that from other animals in view of its tendency towards more rapid fermentation.

Ground Clare Phosphate, which is an extremely insoluble form of Phosphate, was used as the source of Phosphate as it was the only form available.

The straw, which had been adequately wetted, was made into compact heaps of about three tons each, there being two heaps of straw wetted with water and three wetted with dilute liquid manure.

In treatments 1, 2, 4 and 5, fresh stable manure was placed between alternate layers of straw at the rate of about 10 cwt. per 3 to 4 tons of wet straw, while in treatments 2 and 5 Ground Clare Phosphate, in addition, was intermixed with the wet material at the approximate rate of 2 cwt. per 3 to 4 tons of wet material.

During the process of decomposition the degree of fermentation was recorded by maximum thermometers which had been so placed in the heaps that they could be read at intervals.

Towards the end of the first week all the heaps were heating freely and by the middle of the second week the temperature had reached about 130° F. in each case. Though the heaps were then trampled to control the fermentation, the temperature still continued to rise for some days and finally reached

a maximum of 146° F. after which it fell rapidly. There was practically no difference between the temperatures recorded for each treatment.

It was also noticed that the material on the top and sides of each heap gradually dried up during dry weather and decomposition was consequently retarded on the outside.

When the heaps were opened subsequently and examined, it was seen that, with the exception of the material that had dried on the sides and top, decomposition had proceeded to a marked degree in all of them. A dark coloured moist material, closely resembling well-rotted farmyard manure in appearance was produced and there was no difference in the appearance of the material produced by the different treatments.

Samples of the decomposed material were analysed and the following results obtained :—

	Total Nitrogen	Total P_2O_5	Total K_2O
	per cent.	per cent.	per cent.
Straw + water + stable manure	0.31	0.16	0.31
„ + „ + „ „ + Clare Phosphate ..	0.29	0.31	0.46
„ + liquid manure + Clare Phosphate	0.27	0.49	0.37
„ + „ „ + stable manure	0.34	0.17	0.61
„ + „ „ + „ „ + Clare Phosphate	0.36	0.45	0.60

As would be expected, the analyses of the products obtained from the different treatments were variable. It will be seen, however, that there was practically no difference in the total nitrogen content except that the comparable heaps treated with liquid manure were slightly higher in total nitrogen than those which had been treated with water.

The addition of both liquid manure and fresh stable manure appreciably raised the K_2O content of the product.

Where the Ground Clare Phosphate had been added there was an increase in the total P_2O_5 but, as already pointed out, this was a very insoluble form of phosphate and it cannot be assumed that its incorporation with the decomposing straw rendered the phosphates more available as a plant food. When obtainable, a more soluble form of phosphates would be preferable. There was no difference in total phosphates with the other treatments.

An average sample of farmyard manure, produced under ordinary condi-

tions, contains about 0.50 per cent. total Nitrogen, 0.23 per cent. total P_2O_5 and 0.60 K_2O. The artificial farmyard manure, produced by the foregoing treatments, therefore, compares rather favourably with ordinary farmyard manure. Where increased quantities of solid and liquid excreta are used the resulting product should still more closely approximate to ordinary farmyard manure.

SUMMARY.

The results obtained from the foregoing experiments and observations made during their progress would indicate that fresh stable manure, liquid manure or both, may be profitably used as " accelerators " for the decomposition of straw. It is also probable that equally good results would be obtained from the excreta of other farm animals. Success, however, would be dependent upon :—

1. Having the straw thoroughly wet.

2. Mixing in the solid and liquid excreta.

3. Making the material into a compact heap and allowing it to ferment.

4. Prevention of the heap from becoming too dry by having it surrounded with an improvised wall of clay or by some more permanent structure.

The process of decomposition would be favourably influenced if the work was carried out during the early winter months when the material would be subjected to repeated wettings by rain and when there would be less likelihood of its becoming too dry.

The production of artificial farmyard manure is of particular importance to farmers who have surplus straw but who have not the facilities for converting it into manure in the usual way. This product, while not being quite as rich in fertilizing materials as well-made farmyard manure, would provide a good substitute.

Acknowledgment is gratefully made to the staff of the Agricultural Chemistry Department, Albert College, for the determination of the chemical analyses of artificial farmyard manure.

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CIDER ORCHARD DEVELOPMENT IN SOUTH TIPPERARY

BY

T. J. Walsh, B.Agr.Sc.

The manufacture of cider on factory lines has never had widespread development in this country, though the manufacture of home-made cider

Large trees of cider varieties of apples at Gormanstown, Ardfinnan, 1942.

was carried out in many parts of the country for hundreds of years Those districts traditionally associated with cider-making still form important centres of apple production though the growing of cider apples proper is localised now in a few districts in South Tipperary Cider-making in this area appears to date back to very ancient times and although written records regarding its development are singularly silent, yet there is every reason to assume that cider-making, by somewhat primitive methods, existed in very early times and that the native chieftains and the monastic institutes of the period utilised the apples then available for the production of a thirst-quenching beverage.

We do not know the names of the varieties of apples which were grown in these far distant times and many of the varieties now called " old " have

been introduced from the fourteenth century onwards, but, more recently, Arthur Young in his "Tour in Ireland" (1776-79) makes a number of references to cider-making and cider orchards. "Limerick is famous for cider," he says, and recording some observations made at Sir Lucius O'Brien's place, Dromoland Castle, near Newmarket-on-Fergus, Co. Clare, he writes, "This country is famous for cyder-orchards, the cakagee especially, which is incomparably fine. An acre of trees yields from four to ten hogsheads per annum, average six, and what is very uncommon in the cyder counties of England, yields a crop every year. I never beheld trees so loaden with apples as in Sir Lucius O'Brien's orchard; it amazed me that they did not

Cider trees planted along the avenue to farmhouse.

break under the immense load which bowed down the branches. He expected a hogshead a tree from several."

Writing of his visit to Mr. Dominick Trent at Dunkettle, Co. Cork, Young says, "From fourteen acres of orchard Mr. Trent makes sixty hogshead a year of cyder; a clear acre of good trees about seven hogsheads." When staying with Mr. Cornelius Bolton at Ballycanvan House, on the estuary of the Suir, six miles below Waterford, he received a recipe for cider-making which he records in great detail. Elsewhere he writes: "Mr. William Atkinson, of Mount Wilkinson, near Ballycanvan, seems to be very attentive to the orchard husbandry; from two acres he had twenty-one hogsheads of cyder, and the same year reaped twenty barrels of wheat under the trees, a produce little short of £50, or £25 an acre; three and a half barrels of his apples (each 6 bushels) made a hogshead of cider."

It is quite possible that cider-making may have been carried on in other areas at this time though Arthur Young does not record it. He makes no reference to the Ballyduff district of Co. Waterford or to South Tipperary as centres of cider-making, two areas which in more modern times have made for themselves something of a reputation. Cider is still being manufactured at Dungarvan though almost all the cider orchards with which the Blackwater Valley used to abound, particularly around Ballyduff, are now no more, or with great age have become unproductive. No new cider orchards have been laid down in this area to make good the loss, and culinary varieties of apples are largely used as a substitute. The art of home cider-making

Part of six-acre field pastrre field planted 1940.

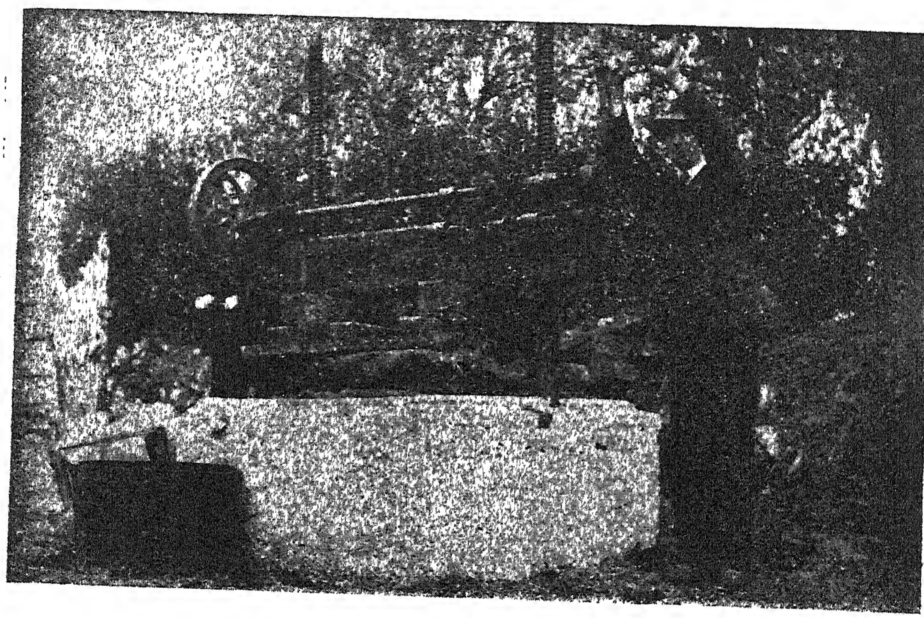
has disappeared from Co. Waterford; but in a factory at Dungarvan a small quantity of cider and perry is produced each year. The making of home cider seems to have long since disappeared also from Co. Limerick and Co. Clare, and the only area of the country where cider-making is still carried on, both on factory lines and on the farms, is in South Tipperary.

This gradual decline in home cider production appears to have been in progress throughout the country during the past thirty-five years. In Vol. VII of the *Journal* (July 1907) it is recorded that home cider-making was then in existence in five different counties and to satisfy the interest then apparent, considerable detail is given regarding the procedure to be followed and the precautions necessary in the manufacture of the beverage at home.

South Tipperary has many old cider orchards planted towards the end

of the last century which, through neglect and age, have already passed their maximum cropping capacity. Very likely the quantity of good cider apples available there now would be insignificant were it not for the fact that the farmers used the crab seedlings growing on the fences as a stock for the grafting of named varieties. Some twenty or thirty years ago much grafting was carried on but unfortunately in South Tipperary this is now almost a lost art with the farmers, and little grafting, if any, has been carried out since the last war. Cider trees growing on the fences and in production are still a feature of certain areas around Clonmel.

The manufacture of home cider in this area reached its peak during the



Twin Screw Press at work near Ardfinnan.

early part of this century. At that time the Co. Committee of Agriculture for Tipperary (South Riding) employed an instructor skilled in cider-making, who visited the various farms giving advice on the manipulation of the mill and the press and on the manufacture of the cider.* Through experience many growers with a knowledge of cider apples, by carefully blending good varieties, were able to produce an article of very high quality, and it is still quite common to hear farmers praised for the quality of the cider they used to make, though the home manufacture may have been discontinued for a long time. When home cider-making was at its height, crushing machines and presses went around the cider districts at harvest time grinding the fruit and extracting the juice. The introduction of the twin-screw press about thirty years ago made extracting much more efficient as well as being

*** See Fifth Annual General Report of the Department of Agriculture and Technical Instruction, 1904-05, page 36.**

less wasteful. It is interesting to note that one large press for hire was kept in commission for three months during each season. Only a few of these machines are still in working order, and no longer do they make the annual visits at harvest time. Where machines are still in use, near Slievenamon and in the district around Ardfinnan, orchard owners now bring their fruit to be crushed and pressed, but the extracted juice is rarely fermented; instead it is used in the fresh state as a refreshing drink for the harvesters. For commercial cider the old press has been discarded and is replaced by power machines of greater output and efficiency.

Until recent years the manufacture of home cider was considerable, the

Apple Crusher—preparing the fruit for the home cider maker.

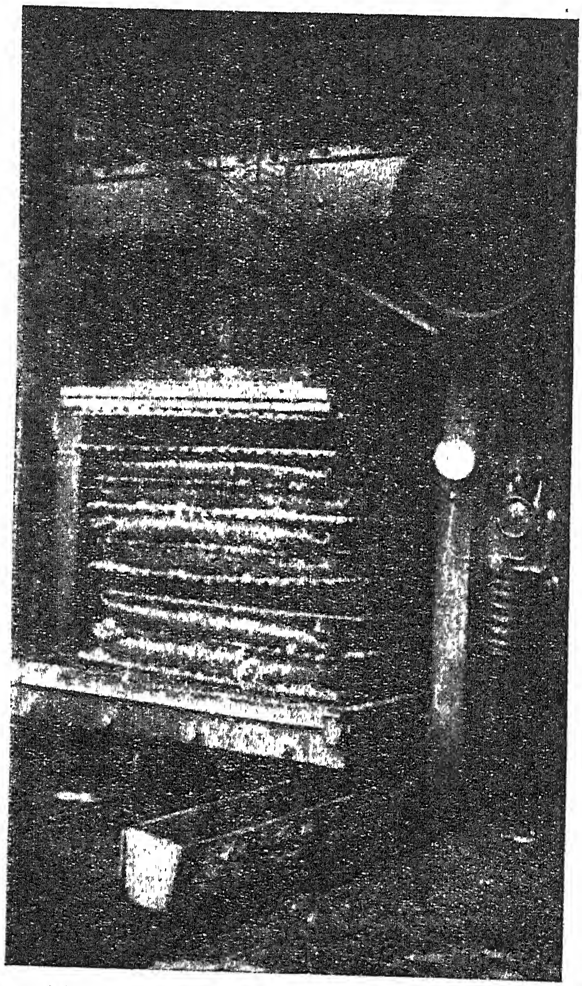
vintage used for home consumption, or sold to the trade for distribution. Some orchard owners marketed their produce under their own particular label and in this way built up a demand for their own particular brand. But with so many farmers making and marketing their own produce there was lack of uniformity as well as irregularity of supply, and the demand in consequence gradually moved round to factory cider, a product of recognised standard and purity, free from the disadvantages associated with the local rural beverage.

The establishment of the cider factory at Clonmel in 1934 by Messrs. ulmer Magner Ltd., initiated a new demand for cider and afforded an pportune outlet for cider apples, culls, and wildings.

The cider manufacturer values apples in respect of the percentage of

acidity and tannin they contain, and by suitable blending of different varieties, is able to produce a brand of cider possessing the desired acidity and astringency.

Generally speaking, the culinary and dessert varieties of apples are deficient



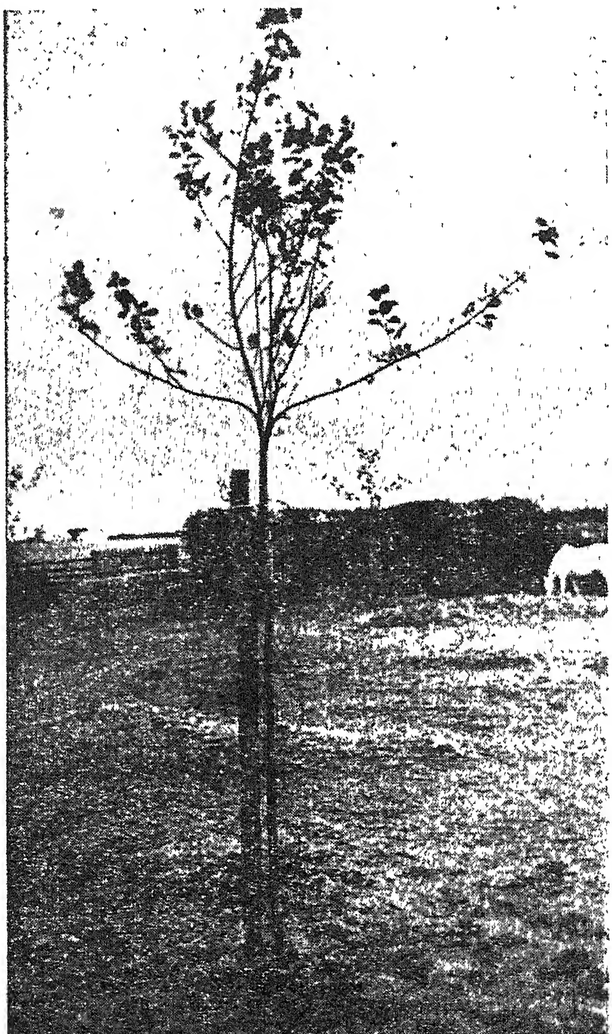
Modern power press at work in the cider factory at Clonmel.

in tannin content, but Bramley's Seedling is one of the most suitable of the non-cider varieties and can be utilised by the manufacturer to a large extent, which is fortunate, because of the large quantities of this variety which are available in the Clonmel area.

Of the true cider varieties, such as Foxwhelp, Blood of the Boyne, Kingston Black, Dabinett, etc., only limited quantities could be obtained locally. Many of the older trees of these varieties had become unprofitable and, in

any case, had not been planted in sufficient quantity to meet the demands of a modern factory.

In 1937, in order to supply the requirements of the factory, the area devoted to the growing of the cider varieties of apples in the neighbourhood of Clonmel,



Cider tree planted in grass showing method of staking and protection.

was considerably extended as a result of an arrangement with Messrs. Bulmer Magner Ltd. The main features of this arrangement were as follows :—

(*a*) the cider apple trees were supplied free by Messrs. Bulmer-Magner Ltd.,

(*b*) a grant of £3 per statute acre was given by the County Committee of Agriculture to the selected fruit grower, to enable him to fence each tree and

(*c*) maintenance grants for upkeep were given by the Committee to each selected grower in the initial stages provided that the trees were pruned, sprayed and otherwise cared for to the satisfaction of the Instructor in Charge.

The planting under the Scheme, it was anticipated, would occupy a period of four years and include about 4,000 trees of suitable varieties.

The first orchards were planted in the spring of 1938, and in that season 75 acres were laid down. Planting was continued each year so that by the end of 1942, 168 acres had been planted comprising 6,720 trees, the number of plot-holders being 98. The smallest unit laid down by any plot-holder was one acre and the largest 10 acres. Trees, as already mentioned, were of the "standard" type, planted at the rate of 40 trees per acre, staked and securely tied and protected with narrow meshed wire. Barbed wire was also used as a protection against cattle damage. Most of the orchards were planted in grass but a few are in tilled ground, and in the latter the vigorous growth as compared with those in grass is most noticeable. Immediately after planting, each tree received a slight pruning; this encouraged breaking, and most of the trees are now going forward to make fine heads. The growth generally has been very satisfactory, and it is reasonable to expect that these trees growing in the rich soil of South Tipperary will eventually yield satisfactory crops. As is usual in the case of cider trees they have been grafted on vigorous stocks and will reach maturity and maximum production very slowly. On the other hand they will probably yield profitable crops over a great number of years. Most of the orchards have been set out in pasture fields but others have been planted in ground that was considered waste. In others again the trees are planted to line the roads and avenues leading to the farmhouses and should present a picturesque sight when the trees are in full blossom.

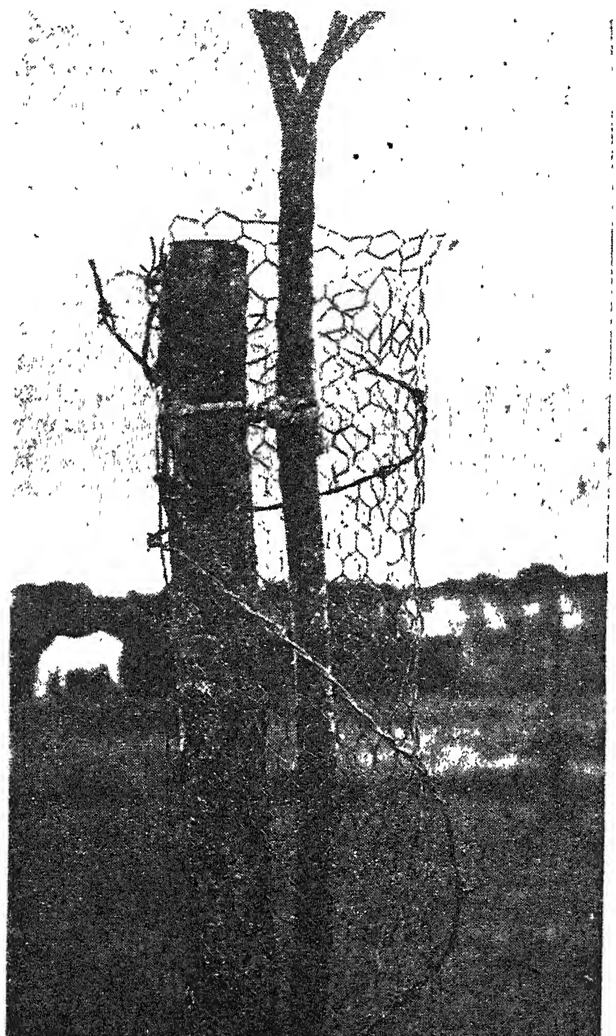
From the farmer's point of view the grass orchard proves suitable because of the fact that the fields are not damaged as grazing units for small stock, the trees being tall and widely planted.

The cider manufacturer also prefers fruit from trees grown in grass orchards. It is chemically more suitable than that produced in cultivated orchards for the production of a high-class cider. Moreover, the crop being usually shaken from the trees is protected to some extent from bruising and can be collected in a cleaner condition than would be possible in cultivated orchards.

The majority of the cider trees planted are of the "bitter-sweet" class as this is the variety in most demand at the factory. The following is a list of the varieties planted and classified according to the season for grinding.

Early Varieties, September–October.

Bulmer's Norman, White Norman, Broad-Leaved Norman, Strawberry Norman, Brown Snout, Abundance, Reine des Hatives, Knotted Kernel, Chisel Jersey, Royal Jersey.



Details of staking and protection of cider tree.

Mid-Season, October and Early November.

Sweet Alford, Bedan, Yarlington Mill, Ecarlatine, Frequin Andievre, Frederick, White Alphington, Marechal, Omont, Grosse Lamette, Meadow Ville, Amère Torrentes, Foxwhelp, Lorna Doon, Cimetière.

Late Varieties, November and December.

Amère de Berthcourt, Binet Rouge, Barbaric Blanche, Frequin Tardiff, Francqueville, Michelin, Medaille D'Or, Kingston Black, Reines des pommes, Upright French.

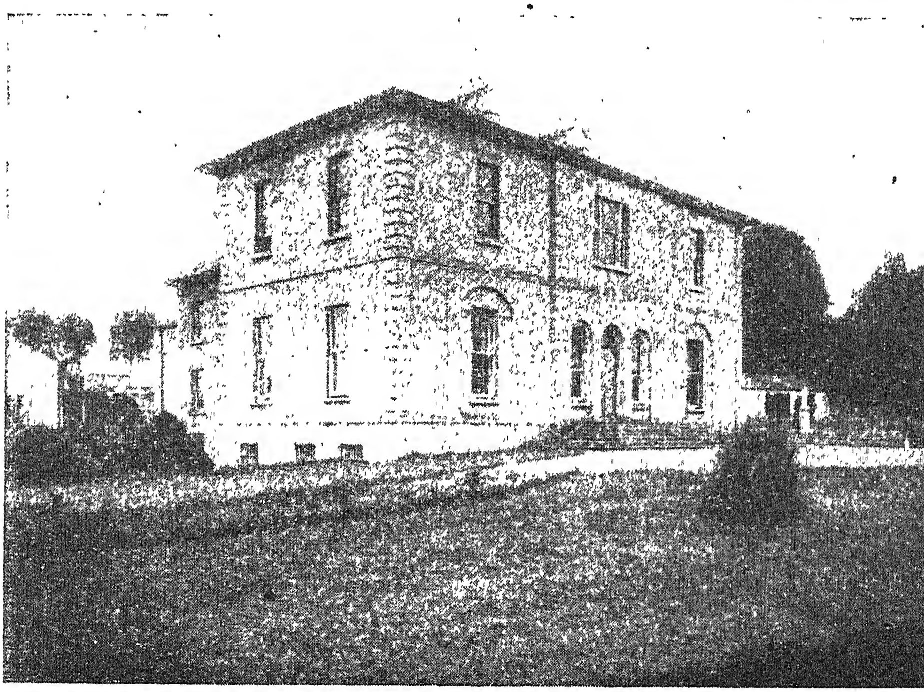
The only cider apples reaching the factory at the present time are from the old local cider orchards, and from the cider trees on the fences, and these could form a considerable tonnage if all were carefully collected. A quantity in the neighbourhood of 3,000 tons of "cull" apples was received at the factory during the 1942–43 season and fruit growers of the area were provided with a profitable outlet for the produce of their orchards, and they have, moreover, the satisfaction of knowing that the factory already has the capacity of absorbing all the fruit of the young cider orchards when these come to full bearing.

The waste or pomace or, as it is called locally, "Crit-ubhaill" was allowed to go waste in the home process of cider-making. Now, however, the factory at Clonmel is manufacturing pectin from the apple pomace. As the pomace comes from the presses it is conveyed to drying lofts where it is dried and afterwards stored. As soon as the factory ceases to take delivery of apples, work on the extraction of the pectin commences. This is the first time pectin has been manufactured in the country along commercial lines.

SALESIAN AGRICULTURAL COLLEGE, WARRENSTOWN, DRUMREE, CO. MEATH

BY A MEMBER OF THE COLLEGE STAFF.

Shortly after the foundation of the first Salesian Agricultural College at Copeswood, Pallaskenry, Co. Limerick, in 1920, by the Very Rev. Father Sutherland, S.C., LL.D., B.A., (Higher Diploma in Education), the Most Rev. Dr. Gaughran, Bishop of Meath, summoned Fr. Sutherland to discuss



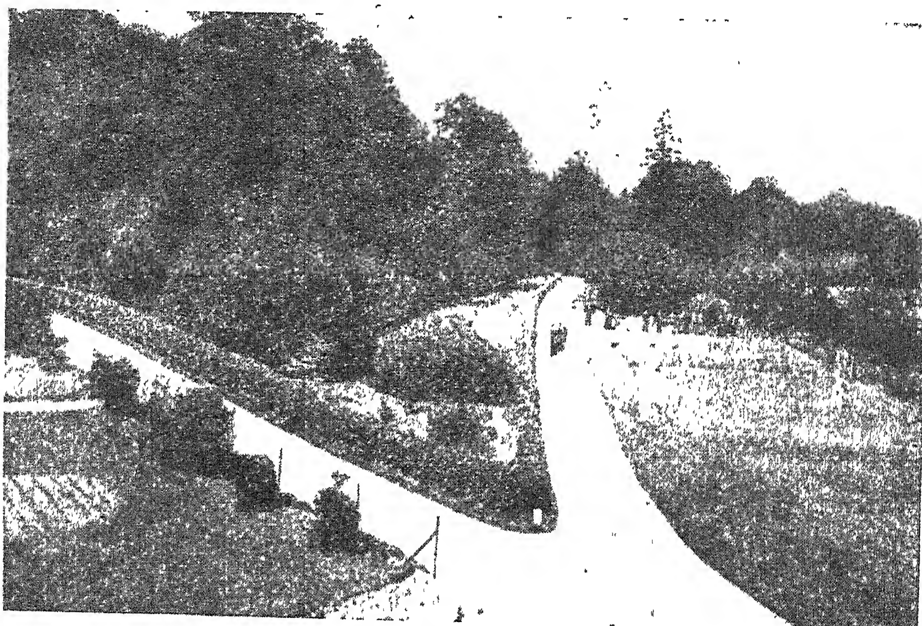
Salesian Agricultural College, Warrenstown, Meath.

with him the opening of a similar foundation in his diocese. It was just about this time that Warrenstown House and Lands, the property of the late Mrs. Elizabeth Lynch, passed, through the generosity of this great Irish lady, into the hands of the Salesians.

After some eight months, spent in effecting necessary structural alterations in the old mansion and its out-offices, to fit it for the purpose intended, the work of teaching began in October, 1923. The first Rector of the College was Very Rev. Fr. O'Grady, S.C. The solemn blessing of the buildings and the chapel was presided over by the Most Rev. Dr. Gaughran, Bishop of Meath.

The College is situated twenty miles north-west of Dublin, in a picturesque and healthy position, and within four miles of the historic Hill of Tara in a country that most have known many of the comings and goings of Blessed Oliver Plunkett, for his kinsmen still reside there.

In 1926 the College was recognised by the Department of Agriculture who arranged to provide financial assistance towards the equipping of laboratories and workshops and who also undertook to make certain annual payments towards the cost of maintenance of pupils and employment of teaching staff.



Salesian Agricultural College, Warrenstown, Meath—Tennis Courts.

Seventeen students were formally admitted on the occasion of the opening of the College. The number of students has since steadily increased and at present they number over sixty. This number tests to the full the capacity of the College. This remarkable development within such a short period testifies to the great popularity of the institute and marks the favour and appreciation bestowed on it alike by students, parents and public bodies interested in agriculture. It proves that the Irish farmers are realising the utility of a scientific agricultural training for their boys.

The syllabus of subjects followed is approved by the Department of Agriculture. A second year's course was begun in 1931 and has been carried on to the present time with remarkable success. This second year's course gives extended facilities to students desirous of building up greater experience and scientific knowledge than could normally be acquired in a single session.

Facilities are also given to students who, on having completed the ordinary course of instruction, wish to take an intensive practical course in specialised work, such as gardening, management of a dairy herd, production of highest grade milk, etc. The main subjects of study are agriculture, chemistry, botany, farm calculations and accounts, horticulture and bee-keeping, veterinary hygiene, zoology, carpentry, forestry and surveying. The students' general education also receives attention, and great importance is attached to their moral and physical well-being. Religious knowledge is, of course, taught and is supplemented by the intensely Catholic atmosphere that prevails. Daily Mass, morning and night prayers and easy access to the Sacraments provide a sound moral foundation for the young men of the future. Physical training is provided by way of outdoor games and other forms of recreation. The College can boast of two very successful football teams and both have figured in the county championships. There are two handball courts, and in summer tennis is played. During the long winter evenings concerts, plays and ceilidhthe are held.

Qualified instructors impart instruction in Agriculture and allied subjects. Furthermore, these Instructors direct and are in charge of the practical training of the students on the farm and in the farmyard. A qualified horticultural Instructor is likewise responsible for theoretical and practical instruction in all branches of that specialised science.

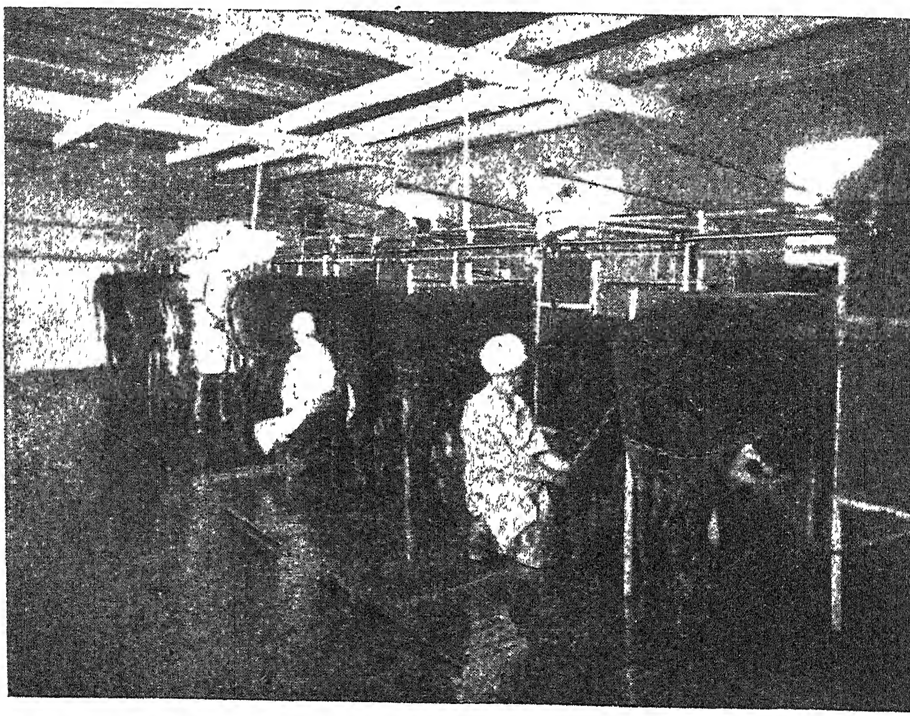
A highly desirable feature is that most of the students attending the College return to farm their own holdings. Nevertheless, not a few find themselves placed in such remunerative positions as land stewards and farm managers. A number secure employment under the various schemes sponsored by the Department of Agriculture. Others take up forestry, horticulture or creamery work. A limited number have pursued advanced courses of studies including the B.Agr.Sc. course at the National University, Dublin, and the Dairy Science degree course at University College, Cork.

The College farm, comprising over five hundred statute acres, was all under grazing in 1923 and might be classed as typical Co. Meath land, with rich heavy soil. The change over from grazing to tillage took place gradually, much time and labour being expended on it. The drainage system of the whole farm was minutely inspected and where necessary, repaired, and renewed. During the early years, the raising of fat stock was continued and tillage was carried on on a small scale. A considerable amount of the estate was let either as grazing or meadowing on the eleven months system but with the passing years the area so let was gradually decreased until 1932 when the whole farm was directly worked by the College authorities.

The farm buildings existing at the time of the transfer of the property were found to be altogether inadequate and had to be remodelled. A new and very modern cow-byre was erected for the housing of the dairy herd

and a separate milking house and dairy conveniently placed and fitted out with the most up-to-date and hygienic appliances necessary for the production of Highest Grade Milk were also erected. Spacious hay-barns were put up in close proximity to the live-stock premises—the whole presenting a very compact and complete block of buildings.

The entire College enjoys the advantages of electric light supplied by crude oil engines of adequate horse power. These engines also provide the motive power for crushing and grinding, for working the milking plant and milk separator, and for sawing. A saw mill and wood-work rooms were erected



Salesian Agricultural College, Warrenstown, Meath—Milking House.

at the outset and here much material has been prepared and work executed from the timber which grew in the College grounds.

While the system of farming is mixed, consisting of tillage, beef-production, dairying, sheep, pigs and poultry-keeping, greatest attention is given to dairying. The present herd which numbers over eighty Tuberculin-tested Shorthorn and Freisian cows has been built up by careful grading and selecting. A large portion of it comprises Registered pure-bred and Non-Pedigree cows and their progeny.

The herd of Irish Large White pigs is made up of animals of excellent type

and most of the female progeny is disposed of for breeding purposes. Some premium boars are distributed under the Department's live stock schemes.

A small flock of Roscommon ewes, crossed with an Oxford ram, is kept.

There is an extensive poultry section composed of the best breeds numbering upwards of two hundred hens and one hundred ducks.

The area under tillage has been gradually increased and now exceeds 200 acres. Wheat, oats, barley, flax, field beans, potatoes, sugar beet, mangolds and turnips are grown. The increase in the tillage area which coincided with the gradual increase in numbers of different classes of farm stock, necessitated heavy expenditure on tractors and other modern machinery or cultivation and harvesting.

Pit ensiling of grass, oats and vetches was initiated successfully. Three silos are now in regular use, the capacity of the largest being 200 tons. Ensilage, together with the large area of root crops, cabbage kale, and catch crops, ensures a generous supply of nutritious food for the dairy cows and younger cattle during the winter and spring months. Recently, owing to the prevailing shortage of imported feeding stuffs for pigs and poultry, a potato silo has been erected. Holding as it does over 18 tons of cooked potatoes it has already proved a great acquisition.

Grassland receives careful treatment, drainage is carried out where necessary, and each year a portion receives manurial treatment according to its requirements. Rotational grazing has been the practice for many years.

When the estate was taken over in 1923 the garden, which was two statute acres in extent, was in a very poor state of cultivation. It had, therefore, to be trenched and manured throughout. The few existing fruit trees which were badly diseased were removed and suitable varieties of apples and bush fruits planted. A hedge of *Cupressus Macrocarpa* was planted enclosing the garden on three sides. In the summer of 1928 the greenhouse was taken down and a new one erected. A second and larger house was erected in 1931. Both of these houses are devoted to the cultivation of tomatoes during the summer and to chrysanthemums during the winter. In 1931 an additional two statute acres of ground adjoining the garden was enclosed. This was cropped with potatoes the first year and subsequently planted with apple trees. The entire four acres are now intensively cropped—there being a continuous rotation of vegetables, early potatoes and catch crops. A section of the garden is set aside as a nursery for the growing of forest trees and these are planted out in the woods and other parts of the estate. Two thousand trees were planted out during the past season.

The grounds adjoining the house were cleared and laid out tastefully. A portion of the site was planted with evergreen deciduous shrubs, including species that flower at different periods of the year.

It may be of interest to give here the daily routine. With the exception of the few who help at the milking the students rise at 6.45 a.m., later assisting at Mass and morning prayers in the college chapel. Breakfast is at 8 a.m., and classes commence at 9.15 a.m. Work in the classrooms continues until 12.25 p.m. with a short break at 10.45 a.m. Dinner follows at 12.30 p.m. At 1.30 p.m. the students are detailed for various duties on the farm, in the farmyard, in the garden and carpenter's shop under the supervision of the Instructors. Practical work ceases at 4.20 p.m. and tea follows at 4.30 p.m. after which there is recreation until 5.30 p.m. when the students return to the classrooms for study until 7.30 p.m. The period following supper which is at 7.30 p.m. is devoted to reading or recreation and the day is brought to a close by night prayers at 9.0 p.m.

The importance of Agricultural Colleges such as Warrenstown is recognised by all progressive countries to-day. Our epoch is essentially one of commercial enterprise and keen competition. Old and easy-going methods must be abandoned, and the newest discoveries of modern research and investigation must be adopted, especially if we are to hold our own in the Agricultural field against alert and highly efficient competitors.

GRASSLAND AND GRASSES IN CO. KERRY

BY

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Grass in its natural or green state, in the form of hay, or to a lesser extent in the form of ensilage, has always been, and is likely to remain one of the most important crops in this country. The area under grass and hay is normally somewhere in the neighbourhood of ten million acres, while the area under all other crops is about one and one-half million acres. Even in the best tillage districts, and on highly cultivated farms, the proportion of grass to all other crops is from 30 to 60 per cent., while in some other districts, until recently at least, the proportion under grass was practically 100 per cent. The bulk of our store cattle, beef, milk and milk products and practically all our mutton are derived from grass while our young horses, and to a lesser extent our working horses, at certain times of the year, are largely dependant on this form of food.

It is not the purpose of these notes to raise the question of tillage versus grazing, the questions of reclamation, or the breaking up of the rich fattening lands of the country. Under any and every circumstance, with even the most extensive schemes of cultivation, grass and hay, having regard to our climatic and other conditions, will always play an important part in the national economy. Taking the position as it is, and assuming that by any means the value of our hay and pasture lands could be improved by as little as a nett 10/- per acre, the national income would be improved by five million pounds annually.

Much of our pasture and meadow lands could be improved by draïnage. Much good and valuable land is at present incapable of drainage and will remain so until the main waterways of the country are opened up. In this connection many useful recommendations are made by the Drainage Commission, which reported in July, 1940.

Land that is water-logged cannot, in the case of grass any more than in the case of other crops, give the best results, no matter to what other treatment it is subjected. Pending a thorough and comprehensive drainage scheme, there are large tracts of grass lands in this country that could be greatly improved by opening up existing dykes and by shallow surface drains made by the ordinary plough in the direction of the fall or slope. In Kerry, as in other counties, attempts have been made to introduce the system of mole drainage, but with little success. This was primarily due to the fact that the operation was always undertaken in the winter month

when conditions for doing the work properly were most unfavourable. If this system is ever to be a success, it should be undertaken in an organised way by skilled workers and preferably during the period from March to October.

Liming is another means of improving both the quantity and quality of grass, and, next to thorough drainage, gives the most lasting results. In Kerry the results from a proper course of liming are truly remarkable, and in some cases almost incredible. This is largely due to the high acidity of practically all kinds of soils in the country. Tests have shown that except in a few coastal sandy areas, the soil is highly acid, a condition as frequently associated with the so-called limestone soils as in the other districts. Sea sand, which is used to a considerable extent in some coastal areas, has given results in counteracting soil acidity which compare very favourably with those obtained from applications of lime. Farmyard manure and good compost, where available, are of no less importance in improving the quantity and quality of grass.

In all districts artificial manures play an important part in hay and pasture improvement, and of these phosphates are the most important. In Kerry soils, Superphosphate shows beneficial results for two or three years at most, Basic Slag for three or four years, and Mineral Phosphates up to seven years. Potash manures, as a rule, show little results in pasture and old meadow lands, but applications of nitrogenous manures show immediate improvements which are, as a rule, short lived. Plots dressed with Sulphate of Ammonia in almost all cases quickly show a marked deterioration in both the quantity and quality of the grass, even in cases where phosphates have been applied at the same time. The increased growth of Bent grass where this fertiliser has been applied is a marked feature, especially in average and poor soils.

A simple and inexpensive way in which pastures and old meadows can be greatly improved is by periodic and thorough harrowing when the earth is dry and bare of grass. This can be done with the tine, disc or even the spring-tooth harrow, or a heavy harrow specially made for the purpose. This operation, which must be drastic to be effective, removes moss, breaks up the old mat, assists in the decay of much dead vegetable matter and allows air and moisture to reach the roots of the herbage. The beneficial result of this operation generally shows itself by a thickening and better growth of the finer quality grasses.

With regard to the management of the grazing animal, the best feeding results are obtained if the pasture is not grazed too bare or close at any stage. A system of rotational grazing, where practicable, by which fields are grazed and rested alternately, adds considerably to the feeding value and the useful life of pastures.

There is one aspect of the grass and hay question that has so far not received the attention it deserves, and that is the question of seeding and seed mixtures. In no other instance in Agriculture, is there such a gap between scientific and technical knowledge and teaching, and practical results in the field. Indeed in some cases, grasses which are classed as "good" are in some districts comparatively or absolutely useless, while some of those classed as "useless" or "inferior" are in practice the most valuable we have. The reasons for this state of affairs are many, but the chief one is that nearly all exposed soils will naturally become covered with those grasses or other plants best suited to the conditions, and, in the case of grass-seed mixtures as distinct from the seeds of other crops where the failure to get a good braird is a very serious matter, little or no notice is often taken of the herbage that develops from the seeds which are sown. Other reasons are the variation in soils and climatic conditions which require different mixtures. Until comparatively recent times the bulk of our information on this subject was derived from sources outside this country, where agricultural and other conditions were different. Even at the present time farmers are too prone to look for this information in seedsmens' catalogues. Many of these are helpful, but the information they contain is often unintentionally misleading and unsuited to local conditions. It is also common, even at the present day, for farmers, when about to lay out land, to seek the advice of merchants and their assistants as to the kinds and amounts of seeds to sow. Farmers themselves should be the best judges in this very important matter, but until they are able to identify the common grasses and clovers at least as well as some of the other useful common plants that thrive in their pastures and hay, they can never hope to be in a position to know what is most suitable for their individual requirements.

The identification of grasses, clovers and other field plants is a branch of Agricultural Education as interesting as it is useful, that could with great advantage receive special attention in schools where Agriculture and Rural Science are included as subjects in the curriculum. Specimens to work on, either as mature seeds or the plants in the herbal or flowering stages, are always easily available for the purpose.

The term "grass" is used in a rather wide and loose sense. Grass as we know it, is made up largely of species of the grass and clover families with a mixture of many other plants.

The grass family (*Gramineae*) comprises one of the largest orders in the vegetable kingdom. It comprises about 3,600 species belonging to 310 genera. To this family belong all the grasses in our hay fields and pastures, all our cereals (including maize and rice) and such plants as bamboo and sugar cane.

The clover family (*Leguminosae*) comprises a still larger number of species

—about 7,000—ranging in size from minute herbs to large trees. To this family belong all our clovers and such plants as peas, beans, lentils, and vetches, all of which provide an abundance of food for man and fodder for stock.

With regard to the utility of grasses and clovers the only ones that might be classed as useless, are those that will not grow under certain conditions, or if they do grow, will fail to survive sufficiently long to be of any practical value. Meadow Fescue (*Festuca pratensis*) is usually referred to in text books as one of our best perennial grasses but in practice it will not survive long in many districts or in the poorer soils.

Yorkshire Fog (*Holcus lanatus*) on the other hand, is usually described as a useless grass, but when it grows as it does, in soils where the so-called good grasses will never establish themselves, it becomes a very valuable grass indeed. It is, in fact, incorrect to apply the term "useless" to any grass. Any of the grasses so described will at one stage or another in their growth, or at some season of the year, be readily eaten by livestock. In this connection it might be mentioned that there are thousands of cattle and sheep raised in Co. Kerry, many of which scarcely ever know the taste of the so-called "good" grasses. Our only native breed of cattle—the Kerry—with its many good qualities is a case in point. These animals in their native surroundings live to a large extent on nothing but the "poor" grasses and coarse herbage of all kinds.

It is not the object of this article to encourage the sowing or cultivation of the so-called inferior grasses, but rather to try to answer the question as to what is good and what is inferior under a particular set of conditions. In this connection the following brief notes on the habit of growth of some of the commoner grasses and clovers with particular reference to survival or otherwise may be of interest. They are the result of observations made under more or less natural conditions on the produce of seeds sown alone or as mixtures in ordinary farming practice, especially in the southern portion of the County Kerry.

Italian Ryegrass (*Lolium italicum*).—The value of this grass for hay and green feeding is well-known. Except in rich soils or where well-manured the crop, even in the second year in hay or pasture, is thin and patchy and by the third year has usually given way completely to other grasses and plants.

Perennial Ryegrass (*Lolium perenne*).—In good soils this species may last for three or four years but in the poorer soils it usually disappears after the second year.

Meadow Fescue (*Festuca pratensis*).—Grows naturally to some extent in pastures in a few areas, but not in sufficient quantity to be of any special

value. Sown alone in average soil, it brairds vigorously but does not succeed in getting beyond that stage and rapidly gives way to the "poorer" grasses. Sown in mixtures it is of no consequence in either hay or pasture in ordinary rotational farming.

TIMOTHY (*Phleum pratense*).—Timothy grows naturally in some soils but not in sufficient quantity to be of any great value. When sown in mixtures in the better soils it does well for a few years but in the poorer soils under ordinary conditions the yield of forage from it is negligible.

MEADOW FOXTAIL (*Alopecurus pratensis*).—This plant is found growing naturally in some permanent pastures and headlands. When sown in seed mixtures in the ordinary way it seldom or ever contributes materially to the value of hay or pasture.

COCKSFOOT (*Dactylis glomerata*) grows naturally in good permanent pastures, in headlands and in shady places. Sown in the ordinary way in seed mixtures, at the rate of 7 or 8 lbs. per statute acre, it gives a good return in hay and in grass for a year or two, or longer, in the better soils. In the poorer soils it usually disappears after two or three years.

CRESTED DOGSTAIL (*Cynosurus cristatus*).—This species grows naturally in nearly all soils, but in some districts it grows to such an extent that it predominates over all other grasses. In these cases there is no necessity to include it in a mixture, but in the districts and soils, where the natural growth is less vigorous, it is a valuable addition to a seed mixture.

ROUGH-STALKED MEADOW GRASS (*Poa trivialis*).—When sown in mixtures this grass gives a good return on the richer soils. On the poorer soils it is of little importance as a hay or pasture plant.

YORKSHIRE FOG (*Holcus lanatus*).—This grass grows practically everywhere and under all conditions. It grows particularly well in boggy and reclaimed soils, where very few other grasses will grow. In such soils it gives an abundant hay crop, and in pastures it grows practically the whole year round. Both as hay and pasture it is readily eaten by live stock.

SWEET-SCENTED VERNAL (*Anthoxanthum odoratum*).—This grass grows in almost all soils under natural conditions. In the dry and light soils it forms the bulk of pasture grasses. It is readily eaten by stock in hay or pasture.

BENT GRASS (*Agrostis*).—This grass, of which there are many species, grows vigorously in a variety of soils and in many cases it predominates over all other plants. Its presence under such conditions is a sure indication of lack of Lime. As already mentioned, its growth is encouraged by sulphate of

ammonia, but it disappears as if by magic in most cases where dressings of lime are judiciously applied. During the summer months livestock largely refuse it but in the winter months it is readily eaten on the ground, while in the form of hay it appears to provide very useful fodder.

Tall Oat Grass (*Avina elatior*).—This grass grows naturally in abundance in fences, headlands and waste plains. Sown in mixtures in the ordinary rotation it is of very little value in either hay or pasture.

There are many other natural grasses and plants not of the grass family (but not including clovers) common in pasture and old meadows, which contribute to their feeding value, but at the moment no useful purpose would be served by even a short reference to them.

THE CLOVERS:

Red Clover (*Trifolium pratense*).—Results from ordinary red clover in mixtures vary considerably even where conditions appear to be similar In some cases it grows vigorously while in others it fails to become established particularly in first-crop aftergrass and it often grows so vigorously that for a time it overcomes everything else but in ordinary rotations it seldom lasts into the second year.

Montgomery Red Clover.—Results from this are also very variable. Like ordinary red it will at times temporarily crowd out everything else and just as quickly disappear. In no case examined did it appear to be of a perennial or lasting nature. It is, however, a very valuable addition to a seed mixture under conditions where it becomes established.

White Clover (*Trifolium repens*).—Ordinary white clover lasts for only one year as a rule but the wild white variety which is more permanent is a valuable addition to a seed mixture. In nearly all cases where sown in non-boggy soils it improves the pasture very considerably.

Alsike (*Trifolium hybridum*).—This variety behaves much like ordinary red clover but its growth is less vigorous.

While on the subject of clovers the statement is often made that they will not grow on acid soils, and that their absence is an indication of want of lime. This is very far from the truth, as far as Co. Kerry is concerned. As already stated, most Kerry soils are highly acid, yet a native or indigenous white clover grows in almost all earthy soils, and often in boggy soils as well. There is also an indigenous Perennial Red Clover but this is not so vigorous or widespread as the white. This is a problem which seems to provide scope for further investigation on both scientific and practical lines.

"Ley Farming."—It would be almost impossible at the present time to

discuss the subject of grass without some reference to Ley Farming. Much is being said and written on the subject, but it is well to realise that the system has its limitations. From what has been said about the grasses and clovers above, it will be seen that in large areas, the tendency is for pastures to revert quickly to their original, or native herbage, no matter what mixture of grasses has been sown. In one trial of direct seeding carried out this season, without any nurse crop in fair average arable land, where the work was done in a satisfactory manner, the results so far, in grass production, have not been up to expectations. In this trial the cost worked out at £3 5s. 0d. for seeds, and £1 10s. 0d. for labour per statute acre, or a total expenditure of £4 15s. 0d. No lime or manure of any kind was applied, but if this were done the cost per acre would be very high indeed. This result suggests that in the particular case referred to, much better results would have been obtained if the amount expended on breaking up and reseeding had been used in treating the existing ley as previously described, *i.e.*, harrowing, liming and manuring.

That there are many cases in the poorer soils where the land could be improved by drainage, liming and tillage, and seeded down with a suitable seed mixture there is no doubt. This procedure is not uncommon in County Kerry and there is nothing new or strange about it. The outstanding problem however, is to ascertain what is a suitable seed mixture in these and other cases. This is not a simple problem. It can be solved only by a combination of scientific and practical work of an experimental nature, having complete regard to local conditions and requirements, rather than to conditions which obtain in other countries.

Under our present system of crop rotations, in many cases where land is laid out with mixtures often recommended, or where as very often happens, only heavy seedings of the Ryegrasses and Red Clover are sown, there is a gap in production between the disappearance of the sown species and the growth of the native grasses. How this gap could best be filled in is a matter of great importance over large areas of County Kerry.

It only remains to add that much useful work in connection with the cereals, grasses and other plants has been, and is being done at the Plant Breeding Stations. An extension of this work, as far as the grasses and clovers are concerned, to local areas, where as already mentioned, conditions may be very different, is a question worth serious consideration. This is a matter which farmers in their own interests in the districts concerned should be prepared to take up and pay for, if necessary. Kerry, through its County Council and County Committee of Agriculture, has not been slow to raise money for other Agricultural Schemes, when it was realised that they were for the benefit of the farming community. Once the importance and necessity for further local research and experiments, with a view to improving the pastures and meadows of the county are fully realized, it is quite safe to assume that the matter will be dealt with in the same liberal way.

SOME FACTORS INFLUENCING LODGING IN CEREALS

Broadcast Talk given by P. T. Carroll, M.Sc., B.Agr.Sc., Plant Breeding Division, University College, Dublin, on Saturday, 3rd April, 1943.

The standing power of the stem or "strength of straw" in cereals is second only to yielding capacity in economic importance. The factors which operate in causing lodging have for many years engaged the attention of the plant breeder, chemist, agricultural engineer and farmer alike, and numerous theories have been put forward as to what may cause a weak stem. Lodging, or the "laying" of the stems takes different forms, and in this country it generally occurs at the critical stage of shooting or earing following a spell of rain. A heavy crop is often "laid" by wind and rain and when this happens the expense of harvesting, the loss of grain, and the deterioration in the quality of the grain leave a smaller profit than that from a crop which was very much less in bulk. Varieties of the cereals, wheat, oats and barley of high yielding potentialities exist, and extremely high yields have been obtained under conditions of increased soil fertility and favourable climatic conditions but the limit is set by the ability of the straw to remain erect even under short periods of adverse conditions.

The fact that the environment greatly influences the degree of lodging of a particular variety makes it harder to evaluate "strength" in straw. Varieties which are reputed to be "Strong Strawed" and "Weak Strawed" have been produced, but the knowledge of the factors responsible for these conditions is in many cases at variance.

Many investigators have found some character or association of characters which act as an index of strength of straw, and the plant breeder has to be constantly on the look-out for these characters in order to evaluate his new hybrids, selections and strains, as to their standing ability as parenthood in cereal breeding is a factor for either improvement or retrogression as in any other life process.

Apart from conditions of soil and season the factors which seem to exert the greatest influence on the standing power of cereals are—the variety, time of sowing, thickness of seeding, depth of sowing, disease and manuring. The cereal plant has to be considered as consisting of two portions—the stem, together with its leaves, and the roots. The stem consists of a number of hollow segments of increasing length from the base upwards. The lower ones are very close together, and give rise to numerous roots and side shoots

or tillers. The arrangement in the form of a hollow tube strengthened by partitions at increasing heights from the base allows far more efficient use to be made of the available material to strengthen the stem than if it were of solid construction, but so advantageous is this principle that it may be carried to dangerous limits in varieties which are not naturally short strawed and tend to grow too tall in proportion to the thickness of the stem when grown under conditions of increased fertility. Naturally, the nature of the base of the stem is important, as mechanical principles demand that the stem from above downwards should be proportionately thick and have thicker and firmer walls.

The germinating grain from which the plant arises does not give rise to the main rooting system of the plant, but produces a small number—not exceeding five or six in oats or wheat of short white roots which remain unbranched for some time. These are known as the primary or seminal root system. The plumule or shoot grows upwards and as the young plant develops, side shoots or tillers are formed, and at about the same time, or in some cases, earlier, the secondary or main rooting system is produced from the lower nodes of the stem. These are generally found about an inch below the soil surface, but their actual depth is to some extent influenced by the environmental conditions. Shading and a comparatively high temperature favours the formation of root crowns very close to the surface, while bright sunshine and cold weather conditions have the opposite effect. Oats, therefore, sown early under cold bright conditions will have deeper secondary or main roots than when sown late, especially if the weather is dull at the tillering stage.

Some farmers who have had trouble from lodged crops are under the impression that deep sowing will, by providing a deeper rooting system, enable the crop to stand well, but this is not so. The secondary formation of the main rooting system is near the soil surface depending on the light, temperature, and soil moisture conditions prevailing. Deep sowing is, therefore, ineffective in preventing lodged crops, and indeed it is inadvisable to sow deeper than about 2½ inches. Crops grown in rich soils generally have roots that are shorter, more branched and more compact than those grown in poor soils.

If the plant is to provide good anchorage and penetrate the mineral resources of the soil it is necessary that the farmer should manipulate that portion of the plants' environment—the soil, which is the only part under his control, to the best of his ability—to provide a firm seed bed, to avoid waterlogging so that the plant will have sufficient air and moisture to produce a sturdy root and stem. A root system that suffices for a fine stem which bends easily in the wind may be insufficient if the stem is stiff and the pressure falls on the roots.

On fertile soils, especially where the seeding is heavy, the young leaves

may grow so luxuriantly as to form a dense canopy, thus tending to produce long, thin stems which go down badly at the ripening stage when the plant has attained its full growth, which is a change from the high protein content of the plant when the swollen cells of the stem help to keep it rigid to the mainly carbohydrate content of the ripe straw.

The practice of "cutting back" over fertile brairds of oats with the mowing machine or thistle cutter, so as to prevent shading does not seem to be effective in preventing lodging in rich soils, when the growth conditions subsequent to cutting are particularly favourable and, in many cases, may result in a reduced yield if not done in time before the main shoots or tillers are injured in the operation. In cases where cutting is done early and the weather conditions are dry subsequent to cutting, growth is retarded and lodging often prevented or greatly reduced. This reduction in foliage seems to reduce the size and extent of the root system, thus slowing up growth especially when the moisture content of the soil is lowered.

Early maturing short strawed varieties are to be preferred for sowing under conditions in which there is a danger of lodging, as by being fit to harvest early they escape the bad weather of a late wet season. Such varieties are available, and as the capacity to produce a strong stiff stem is essentially a varietal characteristic it is imperative that only those varieties or strains should be sown when a cereal has to be grown under conditions where there is the danger of a lodged crop.

The rate of seeding depends on many factors, the quality of the seed, the condition of the soil, and the extent of the possible loss due to disease, birds, etc. For oats, a seeding of 14 to 18 stones—wheat 13 to 15 stones, depending on the size of the grain, and for barley 11 stones per statute acre is sufficient when sown with the corn drill, but farmers may well be guided by local experience in this matter, and nothing is to be gained from too heavy a seeding rate, other than the danger of a lodged crop. A good crop of wheat will carry 300 ears per sq. yard, and varieties which have the capacity of "tillering" or "stooling" well do not need to be sown as thickly as those which produce few erect shoots. Potato oats is remarkable in this respect.

As with all crops a rotation should be followed, and the same cereal should not be grown continuously on the same land or root-rotting fungi which cause disease will prevail and increase and thus, endanger the standing power of the crop. This applies particularly to wheat and barley as both suffer from "Take-All" disease.

We now have available in this country supplies of good sound healthy seed of short strawed, high yielding big grained types of the cereals, and I

will mention those varieties or strains which it is desirable to sow on fertile soils, where there is the danger of a lodged crop :—

WHEAT : Of the winter varieties :—

Pajbjerg—of Danish origin, a heavy yielder, produces a short lodging resistant straw, and is the best suited for growing on rich soils. It should not be sown later than the first week in February.

Wilhelmina, Million or Allied varieties—produce longer straw than Pajbjerg on rich soils but stand well unless sown under conditions of extreme fertility ; can be sown up to the third week in February.

Desprez 80.—An early maturing variety, may be sown with safety up to the middle of March. Owing to its short, stiff straw it is very suitable for cultivation on heavy rich land.

Yeoman II.—Stands better than either Wilhelmina or Squarehead's Master, but is not altogether as hardy. It is only suited for cultivation on rich, clean soils.

The best Spring variety to resist lodging is Atle. It is of Swedish origin and produces a short, sturdy straw ; it is high yielding, of good grain quality and may be sown up to the second week in April.

In cases where sowing has to be delayed for any reason the variety April Red, though not normally a good standing variety owing to its long, thin straw, has produced good crops when sown up to the third week in April.

OATS : The varieties of oats most suited for cultivation are :—

Glasnevin Ardri.—Of Irish origin, derived from a cross between Victory II and Glasnevin Sonas, resembles Victory II in habit of growth. Its straw is of medium length and it ripens a little later than Victory, but is lodging resistant and is the best variety now available for cultivation on rich soils. It produces a cream coloured plump grain somewhat smaller than Victory II.

Glasnevin Success.—Of Irish origin, derived from a crossing between Victory and Record. Is suited for sowing in late districts as it ripens early, produces a short straw of high tillering capacity, but produces more infertile grains than Ardri.

Potato (*Ardee*).—This is a distinct strain of potato oats of Irish origin, highly resistant to lodging, it ripens early, produces a well-filled plump grain, white in colour, and yields well, and is remarkable for its high tillering capacity thus making it particularly suited for exposed situations. In districts where Potato Oats have been grown, growers should endeavour to obtain this particular strain.

The oat crop most likely to stand well on land into which a rich turf has been ploughed is an early maturing strong strawed variety of which a comparatively light seeding of well-graded seed is sown early.

There is now no necessity to recommend foreign oat varieties to the Irish farmer as none of them has proved as suitable for general cultivation on rich soils as the varieties mentioned.

Barley.—Because of the scarcity of feeding stuffs and the fact that barley is an even better food for pigs and poultry than oats, more of it should be grown whenever possible. The now well-known variety, Spratt Archer, is the most suitable one for average soils of good fertility. It stands well when fully ripe and is also the variety most suited to the brewing and distilling industries. For rich soils on which it is contemplated to grow barley, the two Danish varieties, Kenia and Maja, are particularly suitable. These are not good malting barleys and should not be grown for this purpose. The standing quality of Kenia is a noteworthy characteristic.

The breeding and selection of early maturing, lodging resistant high quality strains of the cereals is being further continued, and the best way in which this can be done is to sow the single plant progenies under conditions which are likely to produce lodging. A heavy top growth is encouraged by frequent hoeing, etc., and harvesting is delayed until full ripeness is obtained. Many varieties or strains which are otherwise excellent but in which the straw breaks down when ripe are obtained, and are obviously unsuited for cultivation in this country where the climatic conditions often render it necessary to delay harvesting operations for several days after the crop has become ready for harvesting, and it is a real test of the breeder's ability when he recognises the defects of an otherwise good looking strain that proves to be only of mediocre standing capacity.

To conclude, I will summarise some of the factors which may influence lodging and how it may be avoided.

(1) The capacity to produce a stiff straw is essentially a varietal characteristic, therefore, only those varieties or strains which are reputed to be strong strawed should be sown under conditions of soil fertility where there is the danger of a lodged crop. Such high yielding varieties exist.

(2) Naturally short strawed varieties, which are not likely to outgrow their proportions under fertile conditions so that the internal development and strengthening of the whole length of the stem can take place early and gradually which is necessary to support the increasing weight of the stem, resist unfavourable conditions better than those which shoot up rapidly.

(3) Varieties which fail to stand erect after full ripeness has been attained through a natural bending of the straw should be avoided.

(4) Lodging may result from uprooting of the plants in a rainstorm, therefore, sturdy root growth should be promoted by providing a firm seed bed and avoiding stagnation.

(5) The idea that deep sowing by getting the upper inches of the soil to take the bending strains of the stem will prevent lodging is false as the main rooting system forms near the surface depending on the temperature, light and soil moisture conditions, and it may only lead to the production of weak roots.

(6) Overseeding is of no advantage as by the production of a dense canopy of leaves weak overgrown stems may form, thus increasing the danger of lodging.

(7) When cutting or topping has to be resorted to, care should be taken that it is done in time before the main shoots are too far advanced, otherwise a decrease in yield may result.

(8) Early maturing varieties have certain advantages under fertile conditions—by being ripe early they escape what may be a late harvest.

(9) Avoid the increase and spread of root rotting fungi responsible for root rotting diseases by not growing the same cereal too often on the same land ; thus, follow a rotation.

THE BREEDING OF GRASSES AND CLOVERS

Broadcast Talk given by B. Crombie, M.Sc., B.Agr.Sc., Plant Breeding Division, University College, Dublin, on Saturday, 10th April, 1943.

The scientific breeding of grasses and clovers is a comparatively new development. It is a young branch of the science of genetics, itself a modern science. Although some of the herbage species, notably ryegrass and red clover, had been roughly subdivided into local types as early as the beginning of the nineteenth century, it was not until after the Great War of 1914-18 that these species received the careful attention to which they were entitled by virtue of their agricultural value. In this connection it must be emphasised that grassland research should be carried out within the country or region it is to serve. This applies especially to the breeding of improved types of grasses and clovers. Such pedigree strains, if they are to attain to their full potential productivity, must be well adapted to the local conditions of soil and climate and must be highly resistant to the attacks of local pests and diseases. A strain which surpasses all others on its native soil may not do equally well in a foreign country. Hence the necessity for national herbage plant breeding stations.

The average pasture is composed of a medley of grasses, clovers and weeds. In really good pastures, weeds and inferior grasses are practically absent and only the best grass and clover species are represented in the sward. Therefore, in our plans for better pastures we need consider very few species of grasses and clovers. To be exact we can do quite well with three species of grass, namely, ryegrass, cocksfoot and timothy, and two species of clover—red clover and white clover. As these are the only species on our present breeding programme they are the only ones I will deal with in this talk.

Each species of grass and clover varies as much within itself as do the cereal species—wheat, oats and barley. Take, for example, cocksfoot. It is possible to breed as many strains of cocksfoot as there are varieties of wheat or of potatoes. Some of these may be giant plants—up to 6 ft. high. Others on equally fertile soil are dwarf—not more than 2 or 3 ft. high. Some have dark green leaves while others are light green in colour. The majority are upright in growth habit while some are open in the centre or even lie squat on the ground. Some direct their energies to the production of a great mass of nutritious leafy growth, whereas others produce little leaf and quickly run up to unplatable woody stems.

It is seen then that cocksfoot can vary in every conceivable feature—height of plant, colour of leaf, width of leaf, habit of growth and volume of leafage. In addition to these obvious botanical characteristics, it also varies widely in the following important agricultural qualities—disease resistance, length of seasonal growth, persistency or longevity and in the all-important attribute of yield measured in terms of quality as well as quantity.

All the other species of grass and clover show an equally wide range of variation. In fact, throughout these species it is almost impossible to find any two plants that are exactly alike. This extreme variability within the species is due to the fact that all these plants are for practical purposes self-sterile and are cross-fertilized in nature, the grasses being cross-pollinated by wind and the clovers by bees. In this they differ from the cereals which are self-fertile. Consequently, while a cereal variety can be raised from a single superior plant and be absolutely uniform in every respect, a strain of grass or clover has to be built up from the combination of two or more desirable parent plants and must, of necessity, be more or less variable botanically. By careful breeding and selection, however, the plant breeder ensures that the new strain is reasonably uniform from the agricultural point of view and that it is suitable for the purpose for which it was bred, whether it be for hay or pasture, temporary or permanent.

The first step towards the development of an improved strain of grass is to assemble a number of promising parent plants in the form of a museum of living plants. We concentrate on leafy plants as the feeding value of leaf is far higher than that of stem. Such plants can seldom be obtained from commercial stocks where generations of seed production have unduly increased those stemmy plants giving a high seed yield at the expense of the leafy plants with a rather low seed yield. While it is unlikely that we will obtain really good leafy hay plants from commercial stocks, it is almost impossible to derive good plants for permanent pasture from such stocks. Good plants for permanent pastures can be obtained only from the best permanent pastures. It is interesting to know that this truism was appreciated in Ireland more than a century ago. Old records show that many discerning farmers in those days collected quantities of seeds for their own use from their best old pastures, while a few in laying down new pastures resorted to the very laborious expedient of transplanting fragments of pasture sods taken from good pastures that were about to be ploughed up.

We go, then, to the best permanent pastures in the country, preferably in early spring, and collect hundreds or even thousands of plants of the required species. These plants are taken to the research station, carefully separated and planted singly in small pots of soil that has been steam-sterilized to kill all seeds in it. After about two months they are planted in the trial grounds as single plants spaced 2 ft. apart each way in rows

of ten plants to facilitate note-taking. Wild white clover plants obtained from old pastures are similarly treated but are planted 3 ft. apart each way to allow them plenty of space to spread. As the short-lived species Italian ryegrass and red clover are not found in old pastures, parent plants of these species have to be obtained by selecting the best plants from established commercial stocks. Good plants of perennial ryegrass, cocksfoot, timothy and wild white clover may also be obtained by raising seedlings from seeds collected in good old pastures, or from seeds procured from suitable foreign sources. As soon as these seedlings are strong enough they are planted out as already described.

In the trial grounds, which must, of course, be cultivated and kept free of weeds, the plants are kept under close observation for at least two years. During this period every single plant in the plantation is measured and notes are made on its appearance and rate of growth at every season of the year. Many of the plants succumb to disease or die of old age during this endurance trial. Of the survivors, very few, usually not more than 5 per cent. of the original number will come up to the standard of the breeder's ideal.

Vegetative parts of these selected few are then taken into the glasshouse where they are potted in sterilized soil and subjected to a further trial. They are, in fact, progeny tested, that is, the plants are mated in pairs in every possible combination. This is a delicate operation which must be performed with great care. Even in the glasshouse the heads that are being mated are protected after the operation by being covered with transparent paper bags to eliminate the possibility of contamination by stray air-borne pollen. The resulting seeds are sown later on and the families from the various matings are grown under careful observation. If any weakly or undesirable families are found, and this often happens, the responsible parent plants are discarded.

The grass plants now reduced to perhaps 2 per cent. of the original number collected are at last used in the building of the new strain. They are grown side by side in a small glasshouse to ensure perfect isolation from foreign pollen. To prevent in-breeding and to maintain the vigour of the strain, it is desirable to have it based on about 20 parent plants if possible. By dividing these plants into several pieces, sufficient material is obtained to plant a glasshouse of about 30′ x 10′. Such a house will yield from 3 to 5 lbs. of valuable seeds, which can be used for propagation in the following year. They are sown in a well isolated field, at least 500 yards away from any place where other plants of the same species are likely to flower. The seeds are drilled in 2′ rows on a well-prepared seed bed. By this method we can sow a statute acre with 3 to 5 lb. of seed and with cultivation and manuring it will yield up to the maximum.

We can get, say, 500 lb. of seed from one statute acre of this nucleus stock.

By adopting the drilling method we can sow up to 100 acres with this seed in the following year, taking care to keep it still in reasonably good isolation. The produce of this 100-acre area, amounting to some 25 tons of pedigree seed, can then be used partly for further seed propagation sown either broadcast or in rows, but it will mainly be used for the sowing down of pastures and meadows.

The new strain is now on the market, but after the expenditure of so much time and trouble in its development we cannot afford to leave it to its fate at this stage. It may be quickly spoilt in either of two ways, firstly by getting contaminated by the pollen of inferior types when in flower and secondly by the mechanical admixture of the seeds of inferior types due to carelessness at threshing. To maintain the purity and high standard of our pedigree strains, therefore, we must exercise great care and vigilance in the matter of their seed production.

This brings me to a consideration of the whole question of the production of grass and clover seeds in this country. We are already self-supporting as regards rye grass seeds and there is no reason why we should not produce at least a considerable proportion of our own requirements of other grass seeds, particularly cocksfoot and timothy. These seeds, like the ryegrasses, can be threshed by the ordinary thresher properly adjusted. The production of clover seeds is somewhat more difficult but should not be beyond our abilities. Clovers to set seeds must be cross-pollinated by bees, the white clover mainly by honey bees and the red clover by the long-tongued bombus bees. As bombus bees do not appear in sufficient numbers till late June or early July, we have to adjust the management of our red clover seed crop to suit them. Late flowering strains of red clover flower mainly in July, so that they come at the correct time for the bees. Early flowering broad red clover on the other hand flowers much too early and has to be retarded. This is done by taking an early hay crop off it or a cut for silage early in June. The aftermath then grows rapidly and flowers in July. For the threshing of clover seeds a clever huller is necessary or, in its absence, a special clover attachment on the ordinary thresher.

Pedigree strains of grasses and clovers are not bred for prolificacy in seed production but by judicious management and manuring they can be made to yield as much seed as the commercial stocks, without in any way impairing their high qualities. The following are the average yields of seed per statute acre that may be expected from pedigree strains of the leading grasses and clovers :—

	lb.
Italian Ryegrass	800
Perennial Ryegrass ..	600
Cocksfoot	600
Timothy	600

	lb.
Red Clover	300
Wild White Clover from old pasture	30-60
Wild White Clover sown for seed production	120

At present we sow down about 300,000 acres to grass annually. When the present emergency is over there will be a greatly increased area going down to grass. This will cause a rapid increase in the demand for good seeds for much of the land to be sown will be good land and it would be deplorable to lay it waste by sowing it with bad seeds. Good pastures now being broken up can be re-made and made better than ever in a single year by sowing the best strains and adopting proper management.

All this envisages a great programme of seed production of the proper pedigree strains. To fill our present requirements we need about 30,000 acres under the production of grass and clover seeds. The actual production and processing of the seeds should preferably be carried out by co-operative societies of farmers as is the practice in the Scandinavian countries. This system coupled with a scheme of inspection and certification similar to that which has made Irish seed potatoes second to none would inevitably be successful in the case of grass and clover seeds.

In the foregoing brief talk I have endeavoured to outline the possibilities to be realised in the immediate future if we pay proper attention to the plants that make our pastures and meadows. The proposed seed production alone would be worth a considerable amount to our farmers annually, apart entirely from the enhanced value of our pastures.

APHIS RHAMNI BOYER ; ITS OCCURRENCE IN IRELAND AND ITS EFFICIENCY AS A VECTOR OF POTATO VIRUSES

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Occurrence of *Aphis rhamni* in Ireland

In the years 1938 and 1939 a survey of the aphis population of potato crops was carried out by the present writer (7) in certain seed potato districts in Ireland and it was found that the species *Aphis rhamni* occurred in 1939 in large numbers in the Athlone district. This result prompted a wider search for this species in the midlands and a survey was made in 1940 and 1941, of potato crops in this area. This examination, using the method employed in the previous survey (7), confirmed the findings of 1939 namely that *A. rhamni* occurs abundantly on potatoes in the Athlone district and it also showed that the species is present in significant numbers in other seed growing districts close by.

The following table (Table I) shows the distribution of *A. rhamni* in the different districts in the years during which the survey was carried out. The figures for August only are given since it is apparent that this insect does not reach maximum numbers on potatoes until about the middle of that month.

TABLE I.

District	*Aphis rhamni* per 100 leaves in August			
	1938	1939	1940	1941
Tullamore	—	—	21	52
Athlone	—	130	134	129
Banagher	—	—	53	122
Nenagh	—	—	9	13
Kilkee	2	18	3	4
Donegal	0	0	0	—
Athenry	0	7	—	—

It should be pointed out, however, that these figures are averages compiled from counts made in a number of different crops in each district.

In individual crops however, the infestation was often much heavier than Table I would indicate. In many cases the crops were quite close to each other but nevertheless, there was a wide difference in the numbers of *A. rhamni* occurring in them. This variation is shown in Table II which gives the details of a survey made in the Athlone area on August 18th, 1939.

TABLE II.

APHIS SURVEY IN ATHLONE AREA 18TH AUGUST, 1939.

District	Situation of Crop	Variety	No. of leaves examined	No. of *Aphis rhamni* Winged	No. of *Aphis rhamni* Wingless
ATHLONE :—					
Clonown	Low, boggy, sheltered	Arran Banner	50	0	141
do.	do.	British Queen	50	0	75
do.	do.	Arran Banner	100	0	10
Cornafulla ..	do.	Great Scot	100	0	300
do.	do.	Skerry Champion	100	0	168
Drumlosh	Low, boggy, exposed	British Queen	110	0	56
Golden Island ..	Sheltered	Spry's Abundance	110	0	0
Ballygowlane ..	Low, boggy,	Arran Banner	100	0	83
Clonboney ..	Boggy, very sheltered	Gladstone	100	0	228
Rooskagh	V. sheltered	Kerr's Pink	100	0	203
Clonrolla	V. sheltered Upland	Arran Banner	100	0	112
Drum	do.	Kerr's Pink	100	0	81

Variation in numbers was noticeable in other areas also, and was outstanding in the Tullamore area when crops examined 2 to 3 miles west of the town on 22nd August, 1940, gave no *A. rhamni*, while one crop of the variety Skerry Champion (= Buchan Beauty) 2 miles east of the town examined on the same day gave 58 winged and 584 wingless individuals on twelve leaves, giving an index figure of 5350 *A. rhamni* per 100 leaves. In this case the leaves of the potato plant were dying as a result of the injury

caused. Another crop in this area gave 120 *A. rhamni* on one leaf and although 100 leaves were examined in this crop, no more individuals of this species were found. This wide variation is a feature of infestations by *A. rhamni* and is difficult of explanation. Where potato crops occur in which the numbers of *A. rhamni* are high, it indicates that the primary host plant of the aphis is growing in proximity to such crops. Also it is apparent that the intensity of infestation depends in the first instance on the number of winged females from the buckthorn arriving in a crop and producing young there. Therefore, it would be expected that all potato crops situated equidistant from a source of infestation would be approximately equally infested. This does not however, appear to be the case, and the variation does not appear to be due to the variety of potato grown, whether the crop is sheltered or not, or on the type of soil in which the crop is grown.

Life History of Aphis rhamni.

As far as the writer is aware *A. rhamni* does not overwinter in the viviparous state in Ireland and it is unlikely that it does so since attempts to overwinter it in this state in a glasshouse were unsuccessful. The writer has not found it out-of-doors on any host other than the potato, but in experiments with it under glass found that it feeds on *Rumex*, *Plantago*, and *Datura Stramonium*. It has been recorded on many host plants in America (8) including *Chenopodium ; Beta ; Brassica oleracea ; Fragaria ; Plantago* and *Viola*. It is said, however, to oviposit on the buckthorn (*Rhamnus catharticus* and *R. frangulae*) and to spend the greater part of the Summer on these hosts afterwards flying to secondary hosts of which one is the potato. *R. catharticus* is said to occur in Ireland chiefly by the lakes and rivers of the Central Plain and is very rare off the limestone (6). It has been recorded from the localities in which potato crops showing heavy infestations with *A. rhamni* were found, while in areas where this insect was scarce or absent, the Buckthorn is not known to occur. The writer has not had the opportunity of examining Rhamnus bushes during late Autumn or Winter in districts where *A. Rhamni* occurs, but has followed in the glasshouse the life cycle of this aphis from the potato to *R. catharticus* and back to potato. It would seem therefore, that the distribution of *A. rhamni* in Ireland is connected with the distribution of its winter host, the Buckthorn.

Distribution

A. rhamni appears to have a wide distribution on potatoes being recorded from Great Britain, Germany, Holland and the U.S.A. It is said (4) to be one of the commonest aphids on potatoes in England, infestations being sometimes severe enough to cause leaf injury. In Pomerania this species is stated (3) to be the most prevalent aphis attacking the potato crop, while in America (9) it ranks third in its abundance on this host.

Description (12)

Alate viviparous female. Green, head and thoracic lobes black ; a green

band on pronotum or all green; black lateral abdominal spots; black cauda and cornicles; antennae deep brown, base of iii paler; legs yellowish green, apices of femora and tibia dark and the tarsi. Eyes black. Antennae shorter than body; segment i a little wider than ii; iii longer than iv, about as long as flagellum, with 10-14 round sensoria mainly along one side up to the apex, iv equal to v or a little longer with 3 to 6 sensoria; v with 10 to 3 + 1 and not quite twice base of vi; flagellum three times base. Rostrum to second coxae. Cornicles not quite to about as long as antennal segment v; cylindrical and imbricate, variable in length; cauda aucuminate, not quite so long as cornicles, with a few long pale curved hairs. Abdominal lateral papillae pale, small; each segment with a few median irregular rows of short hairs; three large spots each side and a dark patch at base of cornicles caudad; a dark area between cornicles and cauda and some dusky glandular areas on body. Length 1.4 to 1.7 mm.

Apterous viviparous female. Pale green to pale yellowish green with some deeper green lines; antennae same colour as body, apices dusky cornicles and cauda green or yellow green, in some the cornicles slightly dusky at apices; legs same colour as body, apices of femora and the tarsi dusky. Atennae shorter than body; i larger than ii; iii a little longer than iv but now and then equal to it; iv slightly longer than v; now and then equal to it, so that iii, iv and v are sometimes equal; flagellum about two and a half times base; segments with a few short hairs. Rostrum reaches to between second and third coxae, sometimes to the third. Cornicles cylindrical, about as long as antennal segment iii, rather thick. Cauda rather thick and blunt, a little more than half cornicles, 3 hairs each side and 1 or 2 dorso-apical ones. Lateral abdominal papillae small. A few hairs on body. Legs with many spine-like hairs on tibiae. Length 1 to 1.2 mm.

Male Alate. Head and thorax black or dirty brownish yellow and black. Antennae dark; legs green to yellow, apices of femora, tibiae, and tarsi dark. Cornicles black. Cauda deep greenish-brown. Antennal segment iii with 33 to 38 sensoria over the whole length; iv with 17 to 19; v with 6 to 8; iii nearly as long as iv and nearly equal to vi; iv and v equal or iv a little longer than v, base of vi about one third of flagellum and half of v. Cornicles rather short, about equal to base of vi. Claspers black; penis pallid. Length 1.3 to 1.5 mm.

*Developing male.** Immature males may be observed in the colonies on potatoes from mid-August onwards. They are quite conspicuous amongst the other forms on account of their smaller size and characteristic colour. Their length just before the final ecdysis is about 1.0 mm. and they are shorter and more slender than the immature "return migrants" (the form which flies back to and produces the oviparous females on the buckthorn). They are of a reddish-purple colour all over, except for the wing-pads which

*Writer's observations.

are pale and nearly white. The developing "return migrants" have a green body and black head and thorax and resemble in general appearance the developing fundatrigenia, their length being 1.2 to 1.5 mm. just before the final ecdysis.

Virus Diseases Transmitted by Aphis rhamni.

As a result of experiments carried out in North America (10) the conclusion was reached that *A. rhamni* can transmit the disease of potatoes known as mild mosaic. This disease is caused by infection with virus A so that it may be assumed that *A. rhamni* is a vector of this virus. Elze (2) working in Holland found that *A. rhamni* is capable of transmitting the potato viruses A and Y as well as the virus which causes leaf roll. Kassanis (4) in England records the transmission of virus Y of potatoes by this insect while the same author (5) found that it is also capable of transferring severe etch of tobacco. In Holland (13) it was found to transmit mosaic of white clover. On the other hand Smith (11) records consistent failure of *A. rhamni* to transmit potato leaf roll in England while Heinze (3) states that he obtained no transmission of potato viruses by this insect in Germany. It will be seen, therefore, that there is some difference of opinion as to the power of *A. rhamni* to act as a vector of potato viruses.

Experimental Work.

In view of the prevalence of *A. rhamni* on potatoes in the districts in Ireland already referred to it was considered desirable to ascertain if this species could act as an efficient vector of potato viruses in Ireland and the following experiments were carried out. (The experiments are tabulated in Table III).

Leaf Roll. In September 1940, ten healthy potato plants, varieties British Queen, Arran Cairn and Arran Crest were colonised when about three inches high with *A. rhamni* which had been reared on a leaf roll potato plant. The insects fed well on the healthy plants at first, but did not reproduce rapidly and they were removed after a period of a fortnight. As it was late in the season the experimental plants grew rather poorly and no symptoms of leaf roll were observed on them up to the time of lifting. The tubers from these plants were planted in 1941 but none of them produced leaf roll.

Early in August 1941, *A. rhamni* which had been reared on a leaf roll potato plant were transferred to eleven healthy sprouting tubers in pots, the varieties used being Arran Cairn and Kerr's Pink. When the plants had grown to a height of about six inches, more aphids were added to them from the same source and were allowed to feed for a period of four weeks. During that time they fed well and reproduced rapidly. After about eight weeks from the date of the initial infestation two of the Arran Cairn plants showed symptoms of primary leaf roll, the remaining nine plants remained

healthy. Tubers from all these plants were planted in 1942 but only those from the two which showed primary symptoms in 1941 developed leaf roll.

Later in August 1941, a similar experiment was carried out using the varieties President, Up-to-Date and Kerr's Pink. Colonisation was good on all plants and of the fourteen plants used in the experiment, one President and three up-to-date plants developed leaf roll.

In July, 1942, an experiment was carried out to compare the power of *Myzus persicae* and *A. rhamni* to transmit leaf roll. Watson's (13) technique was employed whereby aphids are starved and then transferred to the source of infection on which they are permitted to remain for a period of about five minutes. In the present experiment both species were starved for four hours prior to being placed separately on the source which was a leaf from a leaf roll potato plant. The aphids remained on the source for five minutes and were then transferred to the experimental plants which were young and vigorously growing. Ten potato plants were used for each species, the varieties being Up-to-Date and Arran Cairn and five aphids were added to each plant. Colonisation was good on most of the plants and the aphids were allowed to feed for five days. The results showed that *Myzus persicae* infected seven out of ten plants while three out of ten were infected with leaf roll by *A. rhamni*. This result was confirmed when the progeny of all the experimental plants was grown in the Spring of 1943.

Virus Y. At the end of July 1941, *A. rhamni* which had fed for five days on a potato plant infected with virus Y were placed on three healthy sprouting potato tubers variety Kerr's Pink and allowed to feed for one week. The plants grew to maturity but at no time did they develop any symptoms of virus Y infection. Similar experiments carried out in August 1941 and August 1942 using the variety President also gave negative results. In September 1942, twelve young healthy potato plants of the varieties British Queen, Majestic, and Up-to-Date were colonised with *A. rhamni* which had been starved for four hours and then placed for five minutes on potato leaves containing virus Y. Ten of these plants developed virus Y infection. Later in the same month this experiment was repeated using twelve healthy potato plants. Five of these developed symptoms of virus Y infection.

TABLE III.

Table showing experiments with *A. rhamni* on the transmission of leaf roll and virus Y.

Date	No. of Experimental plants	Time of aphids on		No. of plants infected
		Source	Exp. Plant	
EXPERIMENTS WITH LEAF ROLL.				
19/9/40 ..	10	Reared	14 days	0
1/8/41	11	,,	28 ,,	2
14/8/41 ..	14	,,	5 ,,	4
16/7/42 ..	10	5 mins. (S.)	5 ,,	3
TOTAL ..	45			9
EXPERIMENTS WITH VIRUS Y				
29/7/41	3	5 days	7 days	0
19/8/41	3	Reared	14 ,,	0
14/8/42	6	,,	14 ,,	0
1/9/42	12	5 mins. (S.)	14 ,,	10
9/9/42	12	,,	14 ,,	5
TOTAL ..	36			15

S=Aphids starved before feeding on source.

CONCLUSIONS.

The results of the experiments go to show that *A. rhamni* can act as a vector of potato viruses under experimental conditions. There is also some indication that this species is a more efficient vector of virus Y than it is of the leaf roll virus. The results also suggest that the technique of starvation followed by a short feeding period on the source of infection does increase the efficiency of the aphis as a vector. Again, as far as the results of a single experiment go, it may be concluded that *A. rhamni* is not as efficient a vector of potato leaf-roll as is *Myzus persicae*. How far *A. rhamni* may act as a vector of potato viruses under field conditions is a matter on

which no precise information is available. There are, however, certain factors which would tend to minimise its importance as a virus vector in the field.

It is well known that plants which are old are more difficult to infect with viruses than young vigorously growing ones and since, as far as the writer is aware, *A. rhamni* does not arrive on potato plants in Ireland until late in July, at a time when the plants have reached maximum size and are no longer making new foliage, it is reasonable to assume that this factor of lateness of arrival would tend to reduce the number of infections caused by this insect. Furthermore, the writer has noticed and the fact has been commented upon by Davis (1), that *A. rhamni* tends to remain in colonies on the leaf on which it was produced, moving to new foliage only when overcrowding occurs. This factor also would operate against any large-scale virus transmission by this aphis.

These considerations, notwithstanding that *A. rhamni* has been shown experimentally to be capable of transmitting potato viruses under certain conditions, lead the writer to the opinion that this aphis is not of importance as a potato virus vector under field conditions and does not constitute a serious menace to the production of healthy seed potatoes.

This view is supported by the fact that in the districts where this aphis occurs abundantly, seed potatoes have been grown for many years without any noticeable increase in the incidence of virus diseases in the crops.

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SOME NOTES ON MUSSEL FARMING AND OYSTER CULTURE

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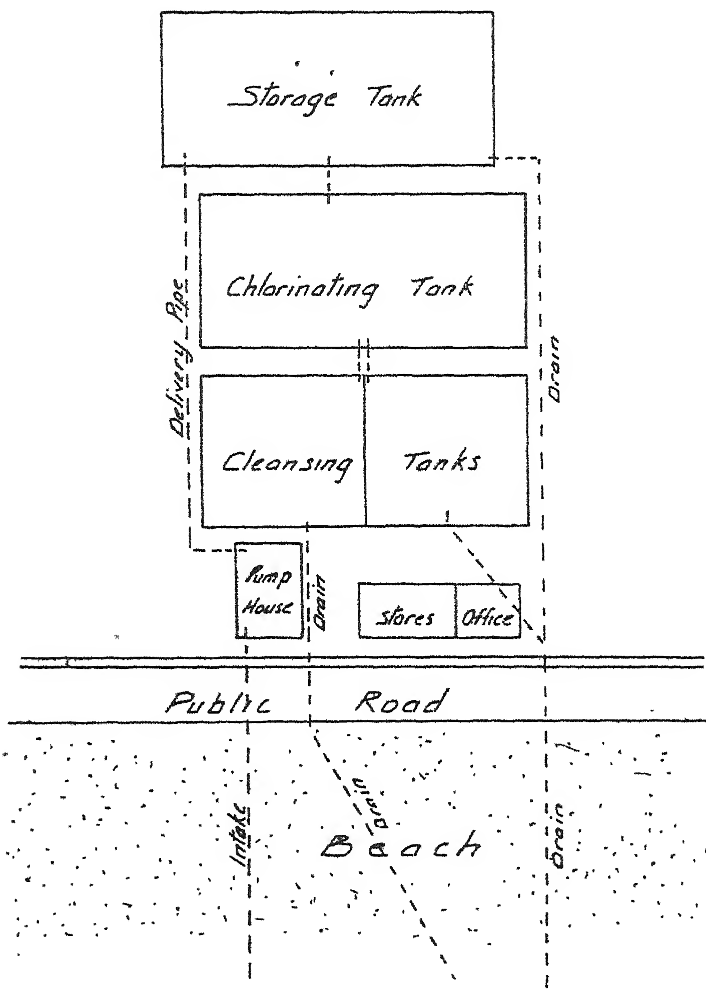
Mussels :

The mussel is highly esteemed as an article of diet in many of the great industrial centres of Britain. The consumption of this shellfish is mainly confined to such centres as Birmingham, Coventry, Northampton and industrial towns further north. In the southern cities and towns the demand is for the periwinkle, but only in very few places are both in request. Unfortunately, the mussel is very liable to pick up the bacillus *coli communis* and also the typhoid germ. British Medical Officers of Health found that when mussels were barred from local markets outbreaks of typhoid died down, and they accordingly decided to refuse admission to any mussels save those duly certified as having been purified at the Conway Station in North Wales, the only official cleansing plant for this shellfish then in commission. There was no such plant in this country, and gradually what had been remunerative markets in England were closed against mussels of Irish origin. The British Authorities intimated their intention of seeking statutory powers to impose a complete closure against the import of Irish mussels unless under some arrangement whereby they would be purified (at the sender's expense) in a British plant before being put on sale for human consumption. Thereupon the Irish Sea Fisheries Association decided to erect a plant modelled on that at Conway. It was clearly necessary to have the plant located at a place where the gathering of mussels constituted an industry of importance to the local community. Dr. Dodgson, the specialist responsible for the layout and operation of the Conway Station, was retained as adviser by the Association, and he chose Cromane, Co. Kerry, as the most suitable of the various sites he had been invited to inspect, and advised generally on the design and equipment of the new station. Cromane Station was formally opened by the Minister for Agriculture in October, 1940, and has been completely successful in rehabilitating our trade in mussels with those British markets which had been closed against them. When the Public Health Officers at these markets applied rigid tests to the sample consignments sent them from the Cromane plant and found them satisfactory, they were only too pleased to reopen their markets to a valuable food supply.

The lay-out of the plant at Cromane is, briefly, as follows: There is a reservoir or storage tank of 120,000 gallons capacity, filled by a motor pump operated at high water. A chlorinating or sterilizing tank is connected by sluices with the storage tank and filled from it by gravity. Below the

CROMANE STATION GROUND PLAN



chlorinating tank, and filled from it by gravity as required, are the twin cleansing tanks, each fitted with timber grids, the lower surface of which is a couple of inches above the concrete floor of the tanks. The mussels are laid on the grids in the cleansing tanks and subjected to a hosing under considerable pressure with the object of removing from the exterior of the shells all adhering rubbish or dirt. When the rubbish or dirt has fallen to the

concrete floor the cleansing tanks are flushed out by means of pen-stocks fed from the chlorinating tank, and all rubbish is run away through the out-fall pipes. During the preliminary hosing process the mussels had closed their shells tightly by way of protection: and they are then flooded over with water slightly chlorinated (the shells still remaining tightly closed) and the chlorinated water gives the mussels simply an exterior bath. Once more the tanks are flushed out. The next step is the de-chlorinating of the sterilized centre tank by the insertion of a certain quantity of hypo, the effect of which is to render the sterile water perfectly free from chlorine; and this sterile water is then let in through the pen-stocks to the cleansing tanks. The mussels lie in sterile water for about 40 hours. They open freely and by natural functioning cleanse themselves of all interior impurities. Once more the water content of the cleansing tanks is sluiced away, and when the mussels have again closed their shells they are given a final short bath in chlorinated water to prevent the possible external adhesion of any of the impurities just discharged by them. When this final bath is finished the mussels are carefully packed in bags which have, meanwhile, been lying in a chlorinating vat; and, each bag having been duly sealed as a container of purified mussels, the consignment goes to market.

Of necessity the output of the Cromane cleansing plant is limited. It deals with a maximum of 900 cwt. a week; and under war conditions there is very considerable demand for mussels in England. While the more important British markets are restricting their purchases to mussels purified at stations like Conway and Cromane, there is a considerable demand at some of the smaller places where local dealers are seemingly not averse to taking a chance. Apart from mussels for human consumption there is a big outlet for mussels for use as bait by English long line fishermen, and quite good prices are being paid for consignments. There is a general rule that mussels consigned for bait must be marked clearly on the bags or containers (or on the labels) with the words "*for bait only*"; but whether all lots leaving this country thus labelled are so utilised or are eventually sold for human consumption is a moot point. It is known, however, that Medical Officers of Health in England are gradually tightening up procedure, and, were it not for war conditions, there would be practically no market for our mussels as food if it had not been for the installation of this cleansing plant. Other districts have been clamouring for similar plants, but some further experience of the economics of the Cromane Station in actual working conditions must be had before an extension of the principle to other areas can be considered.

The following figures show the quantitative increase in mussel exports from Cromane during the past six seasons; but those for 1940, 1941 and 1942 must be read in the light of the abnormal conditions in which the demand for this shellfish has been inflated:—

Season			*Cwt.*
1936	..	..	3,400
1937	..	..	6,384
1938	..	..	6,754
1939	..	..	8,351
1940	..	..	18,966
1941	..	..	22,427
1942	..	..	29,211

The cost of the plant, including pumping machinery, etc., was approximately £6,000, and the price paid for the mussels as taken over directly from the gatherers is 4/– a cwt. The former procedure was that the gatherers themselves had to provide bags and cartage to station (some four miles distant), pay freight, and hope for the best by way of results. Sometimes they got a net return of 2/3 or 2/6 a cwt., but as often as not their consignments were rejected across-Channel and the transactions resulted in a loss.

The quantitative increase in the experts of mussels from Cromane, while in itself satisfactory, has raised the question as to continuity of the supply. The local beds are not inexhaustible and the gathering of mussels if continued at anything like the present rate must result in the undue depletion of these beds. This shellfish grows in clumps or clusters which, if left in their natural state, will increase and multiply without affording the individual mussel a chance of developing to marketable size. Just as with young cabbages and other vegetables, systematic transplantation is essential if the stock of mature mussels is to be maintained. It is fortunate that at the close of the dredging and marketing season, which runs from September to March, men and boats are available for such transplanting operations, and in the current off-season (1943) the Irish Sea Fisheries Association has arranged to have the small mussels (they are about one inch in length) lifted from the congested portion of the grounds (*i.e.*, the seed beds) and re-laid, after loosening up of the clumps, on good clear ground in fairly deep water some two miles further out. Thus the Association's scheme of work comprises a commercial cycle, namely :—

(*a*) transplantation of the " seed " mussels from the congested areas to fresh ground ;

(*b*) the purchase of mussels on maturity in exchange for spot cash to the gatherers, whose responsibility ends when they have lifted and delivered them at the gate of the cleansing station ; and

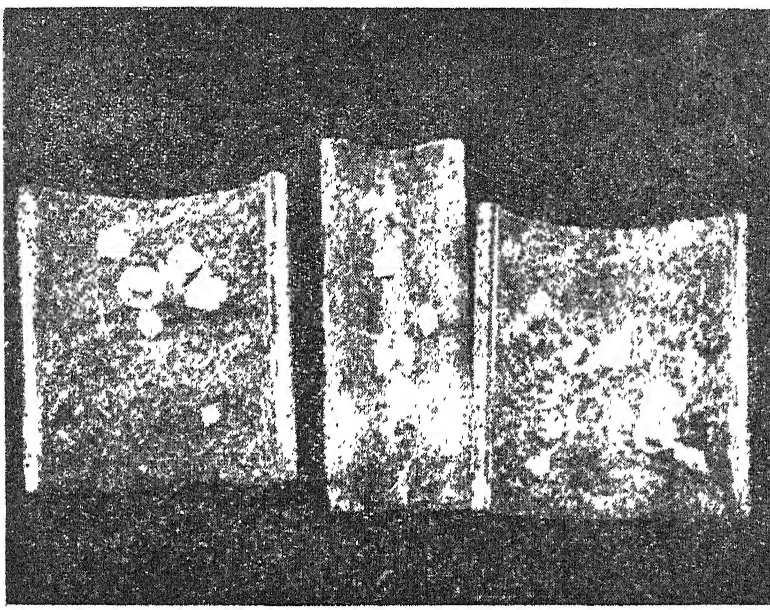
(*c*) The purification and despatch to market of the finished product.

It is the first instance in this country of organised mussel farming, and the

Directors of the Association are to be congratulated upon the manner in which they are thus co-ordinating local effort in the general interest of the locality.

It is probably not generally realised, even by those interested in the study of comparative food values, that, according to experts :

One acre of best mussel ground properly farmed will produce per annum 40,000 lb. of mussels, equivalent to 10,000 lb. of mussel "meat" with a "fuel" value of 3,000,000 calories.



Tiles with some one year old oysters (1 in. to 2 in. diameter) adhering.

Obviously a great deal of importance must be attached to the adverb "properly," and that is what the Directors of the Association are bearing in mind.

Oysters :

Prior to the outbreak of war it was customary for the owners of oyster fisheries in this country to import seed oysters (*i.e.*, young oysters of from one to two years old) with which to stock the beds. Climatic conditions here are not normally suitable for the reproduction of oysters in our home waters. It is necessary to have a water temperature of 17° centigrade upwards to ensure a good spatfall—a condition which prevails with neither sufficient frequency nor duration in our coastal waters. The advent of war conditions precluded the import of seed oysters with the result

that our stocks have become dangerously depleted. In June, 1942, the Irish Sea Fisheries Association undertook a modest experiment in the artificial propagation of oysters, taking advantage of the fact that the tanks of the mussel cleansing station at Cromane were not then in commission for their normal work of treating mussels. The attempt was based on the procedure adopted towards a similar experiment in progress at the Conway Station. The mussel-cleansing plant was ideal for the purpose in mind, consisting as it did of a couple of large tanks, one of which has a capacity of about 120,000 gallons stored at a depth of 5 to 6 feet; and into this tank sea water of strong salinity could be pumped at spring tides as required. The experiment is still in its preliminary stages, but the progress to date may be recorded as follows :—

About 400 matured oysters were procured and placed in the tank. On a suitable tide, chosen during the second week in June, the tank was filled with sea water of strong salinity, about 1,000 tiles having been already placed on the floor of the tank. These tiles were of concrete and curved in shape (somewhat like a split pipe). In the main they measured about 15 inches in length by 6 inches across; and before deposit in the tank each was coated with a mixture of mud, lime and sand. The tiles afford a suitable place for settlement of the spat when liberated by the parent oyster; and coating with the mixture mentioned provides a soft surface which facilitates the removal of the young oysters from the tiles at a later date.

When it was observed during June that the pH or alkalinity of the water was rather low certain materials were added with the object of enriching the plankton content; and when, some time later, it rose to 8.4 the enriching process was stayed. Towards the end of July tow nets were used but no spat were found; and on the last day of that month when a few of the parent oysters were removed from the tank and opened they were found to contain considerable quantities of spawn. About this time a certain cloudiness in the water became evident, a phenomenon held by some authorities to be indicative of a forthcoming liberation of spat. On the 14th August tow nets were again used and it was then that spat was first observed, but it was not readily discernible on the tiles until after mid-September. At the end of September when it became necessary to utilise the tank for mussel cleansing the water was drained from it and the tiles with oysters attached were carefully removed to the upper or storage tank, wherein they have since remained. A count of the young oysters showed that they numbered in all about 5,000; and it is believed that considerably more might have been collected had there been a bigger supply of tiles. At the outset, however, it was thought better to try out only a small number of tiles until preliminary observations of the result had been made. The water in the upper or storage tank was changed daily throughout the winter months (in connection with the normal mussel cleansing work of the station); and

the growth of the young oysters during these months was very satisfactory, as will be seen from the following record of measurements :—

Average diameter for	November	..	4/10ths of an inch.
,, ,,	December	..	5/10ths ,,
,, ,,	January	..	7/10ths ,,
,, ,,	February	..	8/10ths ,,

By May, 1943, the diameter had increased to just over 1 inch, and by early August it had risen to 1½ inches. Normally these oysters would have been removed from the tiles in April, 1943, and relaid on some suitable bed in the sea ; but there being so few of them such a transfer seemed hardly worth while, and it was decided to retain them in the tank for further observation.

During the summer of 1943 work of a similar kind has been carried on but with the number of tiles increased to 5,000 ; and this time the tiles have been cross-tiered in lots of ten, as there seems reason to believe that more spat are collected when all tiles are laid slightly off the bottom of the tank. Owing to certain constructional work at the plant, operations could not be started until the beginning of July and thus part of the 1943 spawning season was missed ; but notwithstanding this handicap the current experiment is well under way and there are good prospects of a successful spatfall.

It is evident that a scheme of oyster culture involving the provision of an expensive station like Cromane, in relation to a comparatively small output of seed oysters, would not be economic. It must be realised, however, that last year's figure of 5,000 is no indication of what may be produced when a large quantity of tiles are used and when more experience has been gained. It is hoped that the figure will then be more in the region of 100,000. The real object of the Cromane experiment is to ascertain what combination of the principal factors, *e.g.*, salinity, temperature, depth, and duration of sunshine prevailing in one season as against another will result in the most abundant spatfall and the most marked development of the young oysters, respectively. When, after the experience of some six or seven seasons, data on this important aspect of the problem has been obtained, it will be possible to furnish advice to the proprietors of private oyster beds for the better management thereof ; and, as regards public oyster beds, to make arrangements (by by-law or otherwise) likely to ensure, subject to weather conditions, a maximum spatfall and development of the resulting oysters.

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LOSSES IN POTATOES DURING STORAGE

BY
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The potato crop has always been an important one in this country, but in recent years it has become of even greater importance in view of its increasing value not only as a source of food for human and animal consumption but also as the raw material for the production of industrial alcohol, of starch, etc.

In previous articles in this *Journal* attention was directed to the production of potatoes generally (1) and to the factors influencing their value for industrial purposes (2 and 3), and in the present article attention is directed to another important feature of potato growing, viz., storage.

There are over three million tons of potatoes produced annually in this country, the greater proportion of which has to be stored for subsequent use during the period between the lifting of one season's crop to that of the next season's crop. It is a well recognised fact that during the period of storage serious loss of valuable food material may be incurred unless reasonable precautions are taken against factors causing these losses. Principal amongst these factors may be included "sweating" and "heating," decay due to wetness and the spread of disease present in tubers at time of storing, sprouting of the tubers during storage, frost injury and damage by vermin.

By careful management in the selection and handling of potato tubers for storage the loss due to these factors may be reduced to a low level. Potatoes intended for storing should be allowed to mature before lifting and if the crop had been "blighted" late in the season an interval of at least two weeks should be allowed between the dying down of the haulms and the lifting of the crop. This will reduce the possibility of potato blight developing on the tubers during storage. Spraying of the blighted haulms with sulphuric acid has been recommended (4) with a view to the prevention of late blight infection of the tubers. The produce of the potato crop should be lifted before heavy winter frosts set in as the potato is very susceptible to frost injury—even slight frost injury affects both the keeping and cooking quality of potatoes, where possible the potatoes should be taken out of the soil in a dry condition to eliminate the risk of loss due to rotting in storage caused by wetness and contamination from adhering soil.

Careful selection of the potatoes to be stored, with a view to the removal of any tubers showing signs of disease or other injury, will reduce the likelihood of the development and spreading of diseases during storage. Even with careful selection of the tubers at time of pitting, some loss due to diseases may be incurred, as will be shown later in this report.

Potatoes continue to respire for some time after being taken out of the soil and unless suitable provision is made for ventilation of the tubers during the early stages of storage heating and sweating will take place with subsequent decay of the tubers. This applies particularly to potatoes that are stored in pits, but also applies to potatoes that are carelessly stored immediately after lifting in large heaps in houses.

Finally, there is the question of loss due to access of water to the stored tubers and of frost injury during the storage period, which again particularly applies to potatoes in pits. The site for the pit should be such that there is little danger of water having access to the tubers, and the pit should be so constructed and covered that rainwater falling on it is run on to the ground. The tubers should be covered with a layer of dry straw, followed by a layer of clay about 6-9 inches deep; as a final precaution the outside of the pit should be thatched. This should afford ample protection against the access of rainwater or of damage due to frosts—even the extra heavy frosts that sometimes occur in this country. Protection against the access of vermin to the stored tubers should also be provided and for this purpose close-mesh wire netting is often used.

The management of potatoes during storage does not, however, end here, as attention is subsequently necessary to prevent undue loss due to the sprouting of the tubers in the pits and stores.

When respiration has ceased in the stored potatoes the tubers undergo a period of rest during which the embryonic sprouts remain dormant. The duration of this rest period, however, is variable and may extend from two to four months varying with the variety, and is influenced by storage conditions. When the rest period has passed the tubers begin to sprout at the expense of the food material stored in the tubers—the greater the degree of sprouting the higher the loss of food material. It is desirable, therefore, to examine the tubers periodically during storage with a view to the removal of sprouts and of any diseased tubers that may be present.

From the foregoing remarks it is obvious that the storage of potatoes entails a great deal more than the mere dumping of them in pits and stores if extensive loss of valuable food material is to be avoided.

In addition to the losses already referred to there are others that are not

so apparent, such as shrinkage in the total weight of tubers stored, and changes in their composition which affects the food or industrial value of potatoes.

In this connection the following experiments were carried out on the College farm to investigate the effects of storage on the weight, starch and dry matter contents of three varieties of potatoes commonly grown in this country, viz. Arran Banner, Kerr's Pink and Up-to-Date.

The experiments were carried out in two successive seasons and were so arranged that the effects of storage for periods of from one to six months were determined.

The potatoes used were of ware size and were carefully selected to exclude tubers showing signs of disease or injury. They were placed in six pits, each pit containing from two to three hundredweight of each variety under examination. The potatoes were taken at random from bulked lots, precautions being taken to keep the different varieties separated in each pit, and the pits were constructed and covered in the usual way consistent with good farm practice. Before being placed in the pits random samples of tubers were taken for starch and dry matter determination. In the first season these samples were taken from bulked lots of each variety, and from the individual pits in the second season.

The pits were opened in rotation at monthly intervals so that records covering periods of from one to six months were obtained.

The potatoes as removed from each pit were divided into edible and diseased, and where the tubers had developed sprouts these were removed and collected. In this way the weight of edible and diseased tubers and of sprouts in each pit was recorded.

Random samples were taken from the edible tubers for starch and dry matter determination by the specific gravity method, using Parow's Tables of Densities and starch and dry matter percentages of potatoes.

The results obtained from these experiments are shown in Tables I and II.

DISCUSSION OF RESULTS.

In the first year's experiment the storage period extended from mid-November to mid-May, and from mid-December to mid-June in the second year.

The early months of the first storage period were abnormally wet and,

although the pits had been well covered with clay and thatch, some rain water gained access to the tubers which had a marked effect on the results obtained in that year, as will be seen from a comparison of the figures in Tables I and II. In the second season rain water was completely excluded from the tubers.

Loss in weight of edible tubers :—In the first season there was an appreciable loss in weight of edible tubers (Table I) the loss being particularly high after five and six months of storage in the case of Kerr's Pink and Up-to-Date and from the fourth month onwards with Arran Banner. It will be observed, however, that this loss in edible tubers was not generally a progressive one with duration of storage, and the variation may be attributed to the fact that the access of rain water was not uniform for the different pits or for the different varieties in each pit. The high loss in weight of edible tubers was mainly due to the serious decay of the tubers which had set in as a result of the access of rain water.

TABLE I.

Variety	Period in Pit	Edible Tubers: Put in Pit	Edible Tubers: Taken out	Per Cent. Loss in Weight	Per Cent. Diseased Tubers	Per Cent. Weight of Sprouts	Per Cent. Dry Matter: In Tubers as Pitted	Per Cent. Dry Matter: In Tubers taken out	Per Cent. Dry Matter: Increase or Decrease	Weight of Dry Matter: In Tubers as Pitted	Weight of Dry Matter: In Tubers taken out	Weight of Dry Matter: Per Cent. Difference	Per Cent. of Starch: In Tubers as Pitted	Per Cent. of Starch: In Tubers taken out	Per Cent. of Starch: Increase or Decrease	Weight of Starch: In Tubers as Pitted	Weight of Starch: In Tubers taken out	Weight of Starch: Increase or Decrease
	Months	lb	lb	Per Cent.	Per Cent.	Per Cent.	Per Cent	Per Cent.		lb	lb	Per Cent.	Per Cent.	Per Cent.		lb	lb	Per Cent.
	1	381	379	0.52	0.00	0.00	20.80	21.60	+0.80	79.25	81.81	+3.23	14.92	16.18	+1.26	56.85	60.68	+6.73
	2	421	419	0.47	3.40	0.00	„	21.55	+0.75	87.57	90.29	+3.11	„	15.75	+0.83	62.81	65.99	+5.06
ARRAN	3	323	310	4.02	3.00	0.00	„	20.60	—0.20	67.18	63.86	—4.90	„	14.82	—0.10	48.19	44.61	—7.43
	4	378	338	10.58	8.00	0.50	„	20.50	—0.30	78.52	68.29	—13.00	„	14.75	—0.17	56.40	49.86	—11.60
BANNER	5	423	348	17.73	11.00	1.50	„	19.90	—0.90	87.98	69.25	—21.30	„	14.13	—0.79	63.11	49.17	—22.10
	6	371	343	34.51	29.20	2.50	„	19.00	—1.80	77.17	46.17	—40.20	„	13.02	—1.90	55.35	31.64	—42.80
	1	420	419	0.24	0.00	0.00	23.60	22.70	—0.90	99.12	95.11	—4.04	17.97	16.88	—0.91	74.62	70.63	—5.35
	2	435	404	7.10	5.00	0.00	„	22.80	—0.80	102.66	92.11	—10.28	„	17.03	—0.76	77.39	68.80	—11.10
KERR'S	3	327	304	7.03	5.00	0.00	„	22.50	—1.10	77.17	68.40	—11.36	„	16.72	—1.07	58.17	50.89	—12.51
	4	434	416	4.14	4.00	1.30	„	23.30	—0.30	102.42	96.93	—5.36	„	17.50	—0.29	77.21	71.80	—7.01
PINK	5	427	355	16.86	9.50	2.50	„	21.60	—2.00	100.77	76.68	—23.91	„	15.78	—2.01	75.96	56.02	—26.25
	6	410	300	26.83	21.40	3.70	„	21.90	—1.70	96.76	65.70	—32.10	„	15.83	—1.96	72.94	47.49	—34.89
	1	400	409	0.00	0.00	0.00	21.10	21.60	+0.50	86.30	88.34	+2.36	15.33	15.82	+0.49	62.70	64.70	+3.19
	2	432	400	7.40	5.00	0.00	„	21.60	+0.50	91.15	86.40	—5.21	„	15.81	+0.48	66.23	63.24	—4.51
UP-TO-DATE	3	375	357	4.80	4.50	0.00	„	21.00	—0.10	79.13	74.97	—5.27	„	15.17	—0.16	57.49	54.16	—5.79
	4	375	352	6.10	3.00	0.75	„	21.50	+0.40	79.13	75.68	—5.26	„	15.75	+0.42	57.49	55.44	—3.56
	5	373	328	12.10	6.00	2.00	„	21.00	—0.10	78.70	68.88	—12.48	„	15.25	—0.08	57.18	50.02	—12.52
	6	368	276	25.00	15.50	3.00	„	20.30	—0.80	77.65	56.03	—26.55	„	14.53	—0.80	56.41	40.10	—28.90

In the second year (Table II) the loss in weight of edible tubers was appreciably lower than that of the previous season; it was, however, more or less progressive with prolongation of the storage period. This loss which, even after five and six months' storage was not very marked, was as much due to sprouting of the tubers as to decay.

Loss due to development of diseases and decay :—As outlined earlier in this paper, care was taken to select apparently healthy tubers for these experiments, but in each year losses due to diseases and decay were incurred. There was an appreciable difference in the loss between the two years, that of the first year being considerably higher than that of the second season which, again, must be attributed to the effects of rainwater which had gained access to the stored tubers in the first season.

It will be observed that in the first year the development of diseases and decay was apparent from the second month of storage onwards and increased rapidly during the fifth and sixth months. The variation in the percentage of diseased tubers in each variety was due to the fact that the access of rainwater was not uniform throughout each pit.

In the second year there were no diseased tubers observed until the end of the third month of storage and even then the loss in weight due to this factor was not very marked, the highest figure being 4.7 per cent. for Arran Banner after six months in the pit; the corresponding figure in the previous year amounting to 29.2 per cent.

A comparison of these results for the two years indicates quite clearly the desirability of pitting healthy tubers and of preventing the access of water to the tubers during the storage period.

Sprouting of tubers.—As already indicated, the sprouting of potato tubers is a natural course during storage and its extent varies for different varieties and conditions of storage. Of the three varieties used in these experiments Kerr's Pink showed a greater tendency towards sprouting than either Arran Banner or Up-to-Date. An indication of the degree of sprouting of the different varieties under examination over the period of storage may be seen from the actual percentage by weight of the sprouts removed from the tubers at the end of each month of storage. It will be observed that in the first year there was little or no sprouting up to the end of the third month of storage, but that there was a progressive increase for the subsequent three months, that is, potatoes pitted in mid-November did not start to sprout until after mid-February in the following year after which the extent of sprouting was appreciably increased particularly during the fifth and sixth months of storage.

In the experiment of the second year sprouting started at the same time,

TABLE II.

Variety	Period in Pit	Edible Tubers		Per Cent. Loss in Weight	Per Cent. Diseased Tubers	Per Cent. Weight of Sprouts	Per Cent. Dry Matter			Weight of Dry Matter			Per Cent. of Starch			Weight of Starch		
		Put in Pit	Taken out				In Tubers as Pitted	In Tubers taken out	Increase or Decrease	In Tubers as Pitted	In Tubers taken out	Per Cent. Difference	In Tubers as Pitted	In Tubers taken out	Increase or Decrease	In Tubers as Pitted	In Tubers taken out	Increase or Decrease
	Months	lb	lb	Per Cent.	Per Cent.	Per Cent	Per Cent.	Per Cent.		lb	lb	Per Cent.	Per Cent.	Per Cent.		lb	lb	Per Cent.
ARRAN BANNER	1	285	284	0.35	0.00	0.00	20.4	20.6	+0.20	58.43	58.50	+0.12	14 63	14.75	+0.12	41.70	41.91	+0.57
	2	285	281	1.40	0.00	0.00	19.9	20.8	+0.90	56.72	58.45	+3.05	14.13	15.00	+0.87	40.27	42 15	+4.66
	3	284	270	4.90	3.30	1.50	19.9	20.5	+0.60	56.52	55.35	—2.07	14.13	14.70	+0.57	40.13	39.69	—1.09
	4	278	261	6.10	2.00	2.20	20.3	20.3	0.00	56.43	53.08	—5.90	14.50	14.55	+0.05	40.31	37.98	—5.78
	5	267	251	6.00	3.80	4.80	19.6	18.9	—0.70	52.33	47.44	—9.34	13.75	13.14	—0.61	38.71	34.51	—10 88
	6	323	295	8.60	4.70	5.71	20.2	19.2	—1.00	65.25	52.64	—19.30	14.37	13 38	—0 99	46 42	39.47	—14.10
KERR'S PINK	1	294	292	0.68	0.00	0.00	21.6	20.8	—0.80	63.50	60.74	—4.34	15.82	15.00	—0.82	46.51	44.80	—3.67
	2	289	285	1.38	0.00	0.00	21.6	21.6	0.00	62.42	61.56	—1.38	15.75	15.75	0.00	45.52	44.89	—1.38
	3	286	280	2.10	1.00	1.60	21.4	21.3	—0.10	61.20	59.64	—2.55	15.63	15.50	—0 13	44 70	43.40	—2 91
	4	332	316	4.88	2.00	1.70	21.0	20.8	—0.20	69.72	65.73	—5.74	15.63	15.00	—0.63	51.89	47.40	—8.65
	5	327	309	5.50	1.30	2.60	20.8	19.6	—1.20	68.02	60.58	—10.93	15.00	13.75	—1.25	49.05	42.49	—13 37
	6	352	312	11.36	3.33	8.70	20.9	20.3	—0.60	73.57	63.34	—13.90	15.13	14.50	—0.63	53.26	45.24	—15.06
UP-TO-DATE	1	299	297	0.66	0.00	0.00	21.8	20.8	—1.00	65.40	61.78	—5.53	16.00	15 00	—1.00	48.00	44.55	—7.18
	2	272	271	0.37	0.00	0.00	21.8	22.5	+0.70	59.30	60.97	+2.81	16.03	16.75	+0.72	43.60	45.39	+4.10
	3	295	288	2.40	1.60	0.30	21.2	21.5	+0.30	62.54	61.92	—1.00	15.37	15.75	+0.38	45.33	45.36	+0.07
	4	274	263	4.01	1.22	1.10	21.2	21.5	+0.30	57.68	56.54	—1.98	15.38	15.80	+0.42	42.14	41.55	—1.40
	5	311	302	2.90	2.30	3.50	22.0	20.8	—1.20	68.42	62.82	—8.18	16.25	15.00	—1.25	50.54	45.30	—10 36
	6	305	291	4.60	2.00	3.70	22.1	20.1	—2.00	67.41	58.49	—13.23	16.35	14.25	—2.10	49.87	41.47	—16.84

that is, from about mid-February onwards, and the extent of sprouting subsequently corresponded more or less with that of the previous year. There was, however, a marked increase during the sixth month of storage, mid-May to mid-June, which was one month later than the final month of storage in Experiment I.

Since sprouts are developed at the expense of the food material in potatoes their removal at an early stage is desirable, consequently the necessity of periodically examining the stored tubers and the repeated removal of sprouts.

Dry Matter of Tubers.—The dry matter content of the varieties Arran Banner and Up-to-Date generally show a slight increase during the early months of storage followed by a progressive decline. The variety Kerr's Pink, however, showed a variable decline in dry matter content throughout the experiment in each year. When this reduction in dry matter is taken in conjunction with the loss in weight of edible tubers it will be seen that the loss in total dry matter may be very appreciable. This was particularly noticeable in the first year (Table I) in which serious rotting of the tubers had occurred and even in the second year (Table II) where the loss in weight of edible tubers was low the total dry matter loss amounted to from 8 to 10 per cent. after five months and from 13 to 19 per cent. after six months storage in pits.

Starch Content of Tubers.—For the varieties Arran Banner and Up-to-Date there was a slight increase in the percentage of starch in the tubers up to the end of the second month of storage in the first year and up to the end of the fourth month in the second year after which there was more or less a progressive decline in both years. The percentage of starch in Kerr's Pink showed a variable decline throughout the experiment in each year. On the whole, the reduction in the percentage of starch in the tubers was higher in the first than in the second year.

The loss in total weight of starch due to the storage of the tubers was very marked in the first year and, although variable, showed a marked tendency to increase during the latter months of storage amounting to from 28.9 to 42.8 per cent. after six months. In the second year the loss in total weight of starch was not so high but generally followed the trend of that of the previous years. The loss after six months, however, only amounted to from 14·0 to 16·8 per cent.

SUMMARY.

Attention is directed to various factors which influence the loss of food material that may be incurred during the storage of potatoes and to the measures to be adopted to minimise these losses.

An investigation, extending over two seasons, into the effects of storing potatoes in pits under ordinary farming conditions is outlined and discussed. This investigation included the effect of storing on, the weight of edible potatoes, the development of diseases and decay, the extent of sprouting, and the starch and dry matter contents of the tubers.

Under the conditions in which these experiments were carried out and for the varieties of potatoes used the results obtained would indicate that :—

1. Even where great care had been taken to include only apparently healthy potatoes in the pits, losses due to development of diseases and decay of the tubers were incurred. This emphasizes the great importance of the careful selection of potatoes intended for pitting or storing.

2. The access of water to the potatoes stored in the pits increased considerably the loss due to development of diseases and decay of the tubers. This indicates the necessity of having potato pits so constructed and covered that all rainwater is excluded.

3. Potatoes placed in pits in November and December did not show much sprouting until about February, after which extensive sprouting took place. From this period onwards the potatoes should be examined at intervals and all sprouts removed. The removal of diseased and decayed tubers at the same time will curtail the spread of disease and decay in the pits.

4. The percentage of starch and dry matter while varying from month to month was not materially affected even after five and six months' storage of the potatoes. When taken in conjunction with the loss in edible tubers due to spread of disease and decay the loss of total starch and dry matter may be appreciable.

References.

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FARM IMPROVEMENTS SCHEME

During the years immediately preceding the present war a marked transformation was rapidly taking place in our towns and rural areas. Erection of new dwelling houses and the renovation of old ones was being encouraged by means of grants and loans, and it can be safely said that without such State assistance this very desirable development would not have been practicable.

Previous to 1940, however, there was no general scheme whereby farmers could obtain assistance by way of grants for the improvement of land on individual holdings, although it must be admitted that land improvement, in this country, is of very great importance.

In the year 1940 the Government set aside funds under the Employment Schemes Vote for the purpose of giving grants to farmers throughout the whole of the country for farm improvement works designed to increase the productivity of holdings. Administration of the Scheme was delegated to the Department of Agriculture.

Before referring to the work done under what is known as the Farm Improvements Scheme, it may be mentioned that there was in operation under the Department of Agriculture a Scheme of Land Reclamation in the *Congested Districts, the object of which was to bring to a condition of permanent utility for rotational cropping a portion of the 300,000 acres of cut-away bog and other types of waste land which it had been estimated were included in small holdings in Congested Counties.

This Land Reclamation Scheme was started in an experimental way in the autumn of 1931 and its activities were extended each successive year so much so that in each of the years 1937-40 an average of 8,239 acres was reclaimed and the average number of small-holders deriving grants was over 11,000 per year. During the nine years when the Scheme was in operation a total of 47,202 acres was reclaimed and grants paid to the total amount

*The scheduled Congested Districts comprise the whole of the Counties Donegal, Sligo, Leitrim, Roscommon, Mayo, Galway, Kerry, County Clare (except the three rural districts of Corofin, Ennis and Limerick No. 2 (Meelick)) and the four rural districts of Castletownbere, Bantry, Schull and Skibbereen in West Cork.

In the above reference to Congested Districts the data given refers in addition to the Congested Districts proper, to an area in North-west Cavan where schemes similar to those applicable to Congested Districts have operated since 1934 and also to a few small areas in other Counties where land reclamation was encouraged by means of grants during the years 1936/37 to 1939/40.

of £212,910. Only farmers, the land valuation of whose holdings did not exceed £25 were eligible to participate. Preference was given, however, to applicants with the lowest valuations when such a course was necessary. The total aggregate grants that could be earned by any small-holder was limited to £20 for the whole period during which the Scheme was in operation and only a few small-holders who did work of outstanding merit received the maximum grant, the practice being, as far as possible, to select newcomers each year.

It will be readily appreciated that each rood of ground " won from the waste " in this way meant a permanent enlargement of the holding concerned without any additional burden in the form of rent or rates.

In order to obtain the best returns from crops grown on this reclaimed land the use of lime or sea sand was encouraged by means of an attractive subsidy during the last four years in which the Scheme was in operation. For that period a total of 52,697 tons of lime were supplied to 39,582 small-holders who satisfactorily completed reclamation work. A quantity of 17,966 tons of sea sand was also supplied during the same period to 2,705 small-holders who similarly carried out reclamation satisfactorily.

In many of the remote parts of the western seaboard lime kilns are far distant from small-holders whose bog soil is acutely in need of lime. An attempt was made to solve this difficulty by giving grants for the erection, at suitable centres, of a type of kiln capable of being fuelled with turf. The maximum grant for such kilns was £10 each. During the years 1935-1940, inclusive, 155 of these kilns were erected in the most needy parts of the Congested Districts. This, coupled with the subsidy referred to above, did a great deal to increase the use of lime. The planning, supervision and certification of all works done under the Land Reclamation, Lime Subsidy and Lime Kiln Schemes were effectively carried out by the staff of Agricultural Overseers and Assistant Overseers, supplemented during the four years prior to 1940 by a small number of Temporary Supervisors.

The more comprehensive scheme of grants for farm improvement works which began to function in 1940 gives full encouragement to land reclamation and, indeed, most of the improvement being done under the new Scheme, especially along the western seaboard, takes the form of land reclamation.

The following types of work were eligible for grants under the Farm Improvements Scheme as operated during the past three seasons: field drainage, including clearing of water courses; reclamation of waste land; construction and repair of fences; improvements in farmyards; construction and improvement of farm roadways.

In the season 1943-44 the provisions of the Scheme are being further

extended to include grants for the construction of concrete floors in cow houses, stables and piggeries and the erection of silos. The conditions of the 1943-44 Scheme are as follows.:—

(1) The Scheme shall apply to holdings owned by persons who earn their living solely or mainly by farming.

(2) Grants are payable to rated occupiers for approved improvement works such as :—

(*a*) Land reclamation and field drainage ;

(*b*) Construction or improvement of watercourses ;

(*c*) Construction or improvement of fences or removal of unnecessary fences which involve waste of ground or impede cultivation ;

(*d*) Improvement of farmyards and the laying of concrete floors in out-offices (construction or repair of buildings is excluded) ;

(*e*) Construction of concrete water tanks, liquid manure tanks and silos, and

(*f*) Construction or improvement of farm roadways.

(3) Subject to the limitation mentioned hereafter and to the conditions of the Scheme being fulfilled, grants shall be equivalent to 50 per cent. of the approved estimated cost of the labour required for improvement works carried out in the season. The approved estimate shall not exceed a maximum of £200, and if an applicant desires to proceed with work requiring a labour cost above what is allowed by this limit, the additional labour cost must be borne wholly by himself.

(4) Except in Congested Districts grants will not be paid for improvement works entailing a labour cost of less than £10.

(5) The maximum grant payable to any applicant in respect of the season shall be £100 and the minimum grant £5, except in Congested Districts where a minimum grant of £1 may be allowed.

(6) Applications must be made on the prescribed form and will, as far as possible, be dealt with in the order of their receipt up to the limits of the money available. Preference will, however, be given to applications in respect of reclamation and drainage works and to applicants who employ additional hired labour.

(7) Joint co-ordinated works between the rated occupiers of adjoining lands may be approved.

(8) Applicants must obtain the approval of the Minister for Agriculture before commencing improvement works and must agree to carry out the improvement works as authorised within a prescribed time and to the satisfaction of the Minister.

(9) Tillage of land reclaimed or drained under the Scheme will be a condition of payment of the grant where tillage is considered necessary to render the land productive, or where the area of arable land in the holding is considered insufficient.

(10) This Scheme shall not include any improvement works which would normally come under any other Scheme or Statute.

(11) Payment of grants for approved improvement works carried out to the satisfaction of the Minister for Agriculture will be made as soon as possible after the completion of the work.

(12) Applicants must undertake entirely on their own responsibility the works approved under this Scheme, and the Minister will not be liable for any damages to any property or person arising out of such works or the carrying out thereof.

(13) The decision of the Minister in all matters relating to the Scheme shall be final.

Out of 5,000,000 acres classed as waste, at least 1,000,000 acres are capable of being brought into cultivation through reclamation and of 12,000,000 acres classed as arable, it can be safely said that 2,000,000 acres are yielding only a fraction of their potential capacity owing to lack of drainage, encroachment by rushes, bracken, ferns, furze or other growths. From this it is possible to gauge the magnitude and importance of the problem of land improvement.

The improvement of the land itself, while the most important, is not the only factor which makes for greater output from the farm. The facilities for conserving farmyard and liquid manure, the lay-out and condition of the fences so as to have straight-sided, suitable sized fields, the provision of serviceable farm roads as well as the other types of work encouraged by the Scheme, all play a very important part by increasing the output from labour and generally facilitating farm operations and transport.

Although the Farm Improvements Scheme started at a time when farmers were distracted by unsettled world conditions, and had to respond to the call for substantially increased tillage, the progress made under the Scheme during the past three seasons can be regarded as very satisfactory. Already there is a general agreement amongst farmers that it is one of the most

attractive State schemes yet introduced and it can be safely predicted that under more normal conditions there will be a keen demand from farmers for its continuance.

Tables 1, 2 and 3 show the progress made under the Scheme each year from its inception. It will be seen that over the period a total sum of £301,742 has been paid in grants and that 42,484 grantees benefited thereby. This disbursement included a sum of £112,190 for grants in respect of 29,404 acres of land reclaimed and a sum of £76,765 paid in respect of drainage works, mainly intensive field drainage. The balance of grants paid was in respect of farm roadways, fencing and farmyard improvements. The basis fixed under the Scheme for the payment of grants was 50 per cent. of the estimated labour costs, subject to a prearranged maximum in certain circumstances.

As a counterpart of land reclamation and intensive field drainage, the Lime Subsidy Scheme which operated with the former Land Reclamation Scheme was continued in the Congested Districts. On holdings under £10 valuation cropping of the reclaimed land in the season in which it was reclaimed was compulsory and applicants who satisfactorily completed reclamation work were eligible to receive subsidised lime or subsidised sea sand up to a maximum of 2 tons per acre in the case of lime and 10 tons per acre in the case of sea sand. The concession in respect of subsidised lime or subsidised sea sand was also given on holdings of between £10 and £20 valuation where land was reclaimed or intensively drained, provided such land was cropped in the season in which the improvement works were carried out.

From the inception of the Farm Improvements Scheme up to the 31st March, 1943, subsidy amounting to £17,094 has been paid in respect of 13,157 tons of lime supplied to 9,192 small-holders and subsidy amounting to £1,261 in respect of 6,721 tons of sea sand supplied to 920 small-holders, who carried out reclamation work satisfactorily. The quantity of lime supplied in recent years shows a decline due to fuel and transport difficulties.

An attempt was made to overcome these difficulties by continuing the scheme of £10 grants for new lime kilns which has been already referred to. By means of these grants a further twenty-six new kilns were erected in the most needy parts of the Congested Districts during the past three years. It was felt, however, that this was not a sufficient solution of the lime difficulty in western counties and in the autumn of 1942 approval was obtained for the giving of grants of a maximum of £6 each for the repair or renovation of existing small turf-fuelled kilns. Under this arrangement 100 kilns have up to the present been repaired or renovated. It is expected that the output from these kilns will substantially improve the otherwise deteriorating lime position.

Particulars regarding the outdoor staff engaged under the Farm Improvements Scheme are shown on Table 4.

In Congested Districts the work was mainly carried out by Assistant Agricultural Overseers supervised by Agricultural Overseers. In the non-Congested Districts a staff of Supervising Inspectors were selected from men who had a number of years previous service with the Department of Agriculture in other capacities. A staff of Supervisors, some of whom were also employed in Congested Districts, were selected by oral examination from young men who had been trained at Agricultural Schools and had a thorough knowledge of practical agriculture.

The work of the entire outdoor staff, as, indeed, that of the indoor staff also, was very arduous as travelling by the former had to be done by bicycle in all kinds of weather. The work of planning, measuring and submitting detailed specifications for all proposed works as well as the task of supervision and final certification was most exacting.

TABLE I.

Farm Improvements Scheme.

Summary of Operations in respect of the portion of the Scheme dealt with up to 31st March, 1941.

County	Number of Grantees	Area Reclaimed (Statute)	Amount of Grants Paid for Farm Improvement Works Included in the Scheme: (a) Drainage	(b) Reclamation	(c) Fencing	(d) Farmyard Improvements	(e) Roadways	Total Amount of Grants Paid
		A. R. P.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Carlow	—	—	—	—	—	—	—	—
Cavan (excluding North-West Area)	5	3 0 0	19 9 6	11 15 0	2 5 0	0 16 9	9 0 6	43 6 9
Clare (excluding Congested Part)	—	—	—	—	—	—	—	—
Cork (excluding Congested Part)	6	—	21 17 5	—	8 4 6	7 9 9	—	37 11 8
Dublin	3	—	57 1 0	—	—	—	4 5 0	61 6 0
Kildare	—	—	—	—	—	—	—	—
Kilkenny	—	—	—	—	—	—	—	—
Laoighis	—	—	—	—	—	—	—	—
Limerick	1	—	—	—	4 2 6	—	1 11 3	5 13 9
Longford	2	—	9 14 6	—	3 18 3	—	—	13 12 9
Louth	1	—	—	—	—	—	15 19 6	15 19 6
Meath	8	—	42 13 11	—	10 6 0	14 8 11	5 6 0	72 14 10
Monaghan	9	21 0 0	23 16 0	40 2 6	3 18 9	—	7 16 8	75 13 11
Offaly	—	—	—	—	—	—	—	—
Tipperary, North	8	18 2 0	6 6 10	54 5 0	2 4 0	0 8 0	1 7 6	64 11 4
Tipperary, South	—	—	—	—	—	—	—	—
Waterford	4	15 1 0	0 12 9	52 7 6	—	—	—	53 0 3
Westmeath	10	22 3 8	30 14 6	34 0 0	1 11 0	7 7 9	3 12 0	77 5 3
Wexford	—	—	—	—	—	—	—	—
Wicklow	—	—	—	—	—	—	—	—
Totals ...	57	80 2 8	212 6 5	192 10 0	36 10 0	30 11 2	48 18 5	520 16 0
Congested Districts								
*Cavan (North-West Area)	—	—	—	—	—	—	—	—
Clare (Congested Part)	20	22 3 17	5 0 0	104 1 9	6 2 6	—	1 7 6	116 11 9
Cork (Congested Part)	—	—	—	—	—	—	—	—
Donegal	43	21 3 7	34 14 9	147 19 1	—	—	7 0 0	189 13 10
Galway (East)	17	16 1 23	—	106 11 1	12 3 0	—	—	118 14 1
Galway (Connemara)	—	—	—	—	—	—	—	—
Kerry	57	47 2 0	17 12 4	264 5 6	24 4 0	—	1 5 0	307 6 10
Leitrim	—	—	—	—	—	—	—	—
Mayo	59	38 1 9	—	222 13 9	—	—	—	222 13 9
Roscommon	17	17 0 38	3 7 6	102 5 3	1 0 0	—	—	106 12 9
Sligo	—	—	—	—	—	—	—	—
Totals ...	213	164 0 14	60 14 7	947 16 5	43 9 6	—	9 12 6	1,061 13 0
Gross Totals ...	270	244 2 22	273 1 0	1,140 6 5	70 19 6	30 11 2	58 10 11	1,582 9 0

*Although not a Scheduled Congested District the Scheme was operated in 14 District Electoral Divisions in this analogous area under the same conditions as in the Scheduled Congested Districts.

TABLE II.

Farm Improvements Scheme.

Financial Year ended 31st March, 1942.

County	Number of Grantees	Area Reclaimed (Statute)	Amount of Grants Paid for Farm Improvement Works Included in the Scheme: (a) Drainage	(b) Reclamation	(c) Fencing	(d) Farmyard Improvements	(e) Roadways	Total Amount of Grants Paid
		A. R. P.	£ s d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Carlow	82	116 3 21	363 18 0	136 5 8	84 17 8	162 19 9	135 0 9	883 1 10
Cavan (excluding North-West Area)	737	275 1 1	2,186 0 11	672 10 0	416 14 8	840 4 10	1,671 17 6	5,787 7 11
Clare (excluding Congested Part)	53	66 0 9	63 17 6	240 0 4	88 8 9	15 3 6	40 19 0	448 9 1
Cork (excluding Congested Part)	991	796 1 21	2,569 14 3	1,748 11 11	1,910 15 10	801 7 6	1,823 2 3	8,853 11 9
Dublin	64	43 3 39	541 18 9	128 0 3	47 13 3	68 16 9	41 19 3	831 8 3
Kildare	92	62 1 11	430 8 5	168 12 5	42 0 3	181 4 6	235 19 6	1,058 5 1
Kilkenny	218	501 0 34	486 6 1	877 18 7	212 11 10	268 9 2	618 3 1	2,463 8 9
Laoighis	289	305 2 14	1,392 11 2	667 19 10	212 9 11	171 7 7	410 7 2	2,857 15 8
Limerick	512	162 2 0	2,100 18 11	322 15 11	701 19 3	631 2 11	866 3 9	4,626 0 9
Longford	718	141 2 14	2,824 9 4	298 13 1	624 7 0	684 5 5	823 19 2	5,255 14 0
Louth	100	55 0 13	330 18 1	103 9 4	99 8 3	194 18 3	338 18 5	1,067 12 4
Meath	404	111 0 6	2,002 7 10	226 8 3	542 16 1	730 17 3	474 17 8	3,977 7 1
Monaghan	272	242 3 13	660 7 2	584 14 6	189 6 1	185 1 10	521 1 0	2,140 10 7
Offaly	366	348 3 27	1,559 8 9	1,008 11 0	151 8 4	486 4 10	601 5 4	3,806 18 3
Tipperary, North	318	676 2 22	1,010 5 3	1,140 14 1	370 13 0	296 12 7	571 11 5	3,689 16 4
Tipperary, South	172	93 2 24	492 17 0	200 11 0	250 18 0	240 3 10	355 18 1	1,540 7 11
Waterford	283	476 2 3	697 3 10	1,307 1 3	389 2 8	370 17 11	358 9 0	3,122 14 8
Westmeath	287	173 2 7	1,229 9 8	375 17 2	321 7 11	353 9 0	361 14 6	2,635 18 3
Wexford	207	281 0 29	582 5 5	542 15 4	308 6 9	96 2 0	272 13 3	1,802 2 9
Wicklow	127	350 1 2	345 15 10	351 6 3	106 18 7	39 15 4	216 2 0	1,262 18 0
Totals ...	6,292	5,281 1 30	21,863 2 2	11,605 16 2	7,075 4 1	6,822 4 9	10,740 2 1	58,111 9 3
Congested Districts								
*Cavan (North-West Area)	250	137 0 11	231 9 2	690 3 4	20 16 0	20 1 0	436 19 2	1,402 8 8
Clare (Congested Part)	700	521 0 13	616 14 2	2,160 18 4	536 9 10	178 7 10	743 1 2	4,265 11 4
Cork (Congested Part)	623	385 0 25	174 17 2	1,996 7 0	268 14 4	118 6 4	510 13 3	3,068 18 1
Donegal	1,696	625 3 22	1,887 13 10	3,795 12 0	523 2 0	41 10 5	1,524 4 5	7,777 2 8
Galway (East)	1,414	1,219 1 39	1,030 10 0	5,888 13 4	855 6 1	365 15 1	834 13 7	9,034 18 1
Galway (Connemara)	794	420 0 12½	25 16 0	2,508 0 2	364 5 3	13 1 9	616 4 3	3,527 7 5
Kerry	1,487	982 1 37	970 12 4	5,195 10 6	959 6 4	514 6 9	966 1 8	8,605 17 7
Leitrim	1,327	750 1 0	542 9 6	4,007 14 4	76 1 7	117 6 7	1,994 11 10	6,738 3 10
Mayo	2,325	1,353 2 3	327 2 1	7,626 13 1	563 6 2	164 18 6	1,537 16 10	10,219 16 8
Roscommon	794	575 2 3	432 1 3	3,010 11 8	695 14 1	187 13 11	805 7 3	5,131 8 2
Sligo	542	436 0 12	199 12 2	1,922 4 1	167 13 8	153 12 8	891 13 11	3,334 16 6
Totals ..	11,952	7,406 2 17½	6,531 17 8	38,802 7 10	5,035 15 4	1,875 0 10	10,861 7 4	63,106 9 0
Gross Totals ...	18,244	12,688 0 7½	28,399 19 10	50,408 4 0	12,110 19 5	8,697 5 7	21,601 9 5	121,217 18 3

*Although not a Scheduled Congested District the scheme was operated in 14 District Electoral Divisions in this analogous area under the same conditions as in the Scheduled Congested Districts.

TABLE III.

Farm Improvements Scheme.

Financial Year ended 31st March, 1943.

County	Number of Grantees	Area Reclaimed (Statute)	Amount of Grants Paid for Farm Improvement Works Included in the Scheme: (a) Drainage	(b) Reclamation	(c) Fencing	(d) Farmyard Improvements	(e) Roadways	Total Amount of Grants Paid
		A. R. P.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Carlow	151	111 3 9	725 7 5	255 3 4	200 7 6	149 2 11	82 4 10	1,412 11 0
Cavan (excluding North-West Area)	1,405	400 2 19	4,502 1 5	1,211 8 10	844 10 5	1,895 14 9	2,340 9 9	10,794 5 2
Clare (excluding Congested Part)	61	83 0 26	34 7 0	296 12 0	84 1 6	37 6 9	116 3 6	568 10 9
Cork (excluding Congested Part)	1,788	1,308 2 23	5,152 5 5	2,868 0 3	3,987 2 5	1,649 2 4	2,918 19 6	16,575 9 11
Dublin	58	47 3 0	581 15 10	123 5 0	53 9 9	148 6 0	119 16 6	1,026 13 1
Kildare	105	39 0 25	799 18 0	105 3 6	146 5 3	56 11 5	142 15 9	1,250 13 11
Kilkenny	354	686 3 35	1,220 14 5	1,902 7 9	471 16 4	492 13 4	548 14 2	4,636 6 0
Laoighis	482	809 1 30	2,534 13 9	1,556 14 9	540 8 0	399 19 0	640 19 2	5,672 14 8
Limerick	975	366 2 7	4,955 4 4	910 18 7	1,654 5 0	837 5 11	1,140 14 1	9,498 7 11
Longford	1,220	256 2 35	4,949 17 5	645 18 3	1,208 5 6	1,470 14 2	1,368 9 5	9,641 4 9
Louth	63	37 0 12	225 5 6	89 17 3	102 9 10	99 11 9	111 5 0	628 9 4
Meath	560	165 3 17	2,621 13 0	344 13 5	1,138 16 6	876 9 10	530 19 9	5,512 12 6
Monaghan	376	277 0 5	1,072 3 5	729 12 3	323 8 8	352 19 2	618 3 4	3,096 6 10
Offaly	584	728 2 26	2,851 16 11	1,910 14 4	338 5 4	726 9 5	949 5 2	6,776 11 2
Tipperary, North	510	744 2 32	1,889 12 8	1,773 15 7	689 17 8	597 10 11	792 16 3	5,743 13 1
Tipperary, South	336	138 3 10	1,040 4 10	556 14 3	471 10 0	551 19 7	555 11 9	3,176 0 5
Waterford	354	504 2 23	934 3 0	1,288 11 9	516 2 2	449 0 7	359 16 8	3,547 14 2
Westmeath	443	289 3 32	2,394 18 10	721 4 1	452 16 7	643 9 0	565 14 0	4,778 2 6
Wexford	357	380 0 14	982 8 11	1,155 19 5	627 1 5	245 15 9	251 1 8	3,262 7 2
Wicklow	149	314 1 12	434 0 2	514 18 4	266 12 9	127 4 9	182 12 9	1,525 8 9
Totals ...	10,331	7,691 3 37	39,902 12 3	18,961 17 11	14,115 12 7	11,807 7 4	14,336 13 0	99,124 3 1
Congested Districts								
*Cavan (North-West Area)	249	111 0 29	181 3 3	647 2 8	7 15 3	25 6 5	661 7 6	1,522 15 1
Clare (Congested Part)	684	655 0 13	776 5 7	2,038 12 8	629 12 2	289 18 5	1,007 12 0	4,742 0 10
Cork (Congested Part)	751	405 1 6	155 7 9	2,175 2 6	485 14 0	215 2 3	741 15 3	3,773 1 9
Donegal	1,822	1,094 2 37	2,460 17 6	3,271 16 5	856 11 2	106 19 6	3,087 2 8	9,783 7 3
Galway (East)	1,613	1,481 0 6	1,126 14 6	6,220 9 3	1,946 11 3	750 11 2	1,331 12 10	11,375 19 0
Galway (Connemara)	699	276 0 29	71 4 6	1,651 5 10	296 13 6	3 17 3	1,403 9 4	3,426 10 5
Kerry	1,843	1,304 2 8	979 3 4	7,315 12 4	1,319 8 11	677 15 2	1,287 9 0	11,579 8 9
Leitrim	1,532	812 1 1	812 2 4	4,522 3 7	93 17 3	265 15 2	2,779 12 7	8,473 10 11
Mayo	2,730	1,400 3 5	615 12 9	8,277 10 6	1,124 15 1	719 7 7	3,602 5 0	14,339 10 11
Roscommon	1,065	713 2 34	606 12 6	3,311 5 7	1,468 14 8	315 5 5	1,009 11 9	6,711 9 11
Sligo	651	524 2 6	404 10 6	2,249 0 2	259 1 3	215 4 9	962 14 4	4,090 11 0
Totals ...	13,639	8,779 1 14	8,189 14 6	41,680 1 6	8,488 14 6	3,585 3 1	17,874 12 3	79,818 5 10
Gross Totals ...	23,970	16,471 1 11	48,092 6 9	60,641 19 5	22,604 7 1	15,392 10 5	32,211 5 3	178,942 8 11

*Although not a Scheduled Congested District the scheme was operated in 14 District Electoral Divisions in this analogous area under the same conditions as in the Scheduled Congested Districts.

TABLE IV.

Particulars of Outdoor Staff engaged under Farm Improvements Scheme during the three Seasons 1940/41 to 1942/43 inclusive.

Non-Congested and Congested Districts	Title of Officer Employed	1940/41 No. of Officers Employed	1941/42 No. of Officers Employed	1942/43 No. of Officers Employed
Non-Congested Districts	Supervising Inspectors (Temporary)	6	6 increased later to 8	8 increased later to 11
	Supervisors (Temporary)	87	79 increased later to 105	105 increased later to 145
Congested Districts	Agricultural Overseers ..	6	6	6
	Acting Agricultural Overseers ..	6	6	6
	Assistant Agricultural Overseers	72	72	72
	Supervisors (Temporary) ..	46	50 increased later to 65	70

PIG FEEDING EXPERIMENTS AT THE DEPARTMENT'S FARMS

A pig feeding trial was conducted at the Department's Agricultural Schools, Athenry and Clonakilty, with the object of comparing the value of raw sugar beet and cooked potatoes when fed to fattening pigs. The trial at Clonakilty was carried out during the period from 26th October, 1942, to 15th February, 1943. At the Athenry centre the trial did not commence until 10th December, 1942, and continued up to 20th April, 1943.

The pigs were from twelve to fourteen weeks old at the beginning of the trial. They were divided into two groups which were similar as regards age, sex, breeding and weight.

Each group received a basal ration consisting of 3 lb. of meal mixture made up as follows :—

Clonakilty Centre :	4 parts by weight of barley meal ;		
	3 „	„	of ground oats ;
	1 „	„	of bean meal ;
	4 pints of separated milk per pig daily.		
Athenry Centre :	4 parts by weight of barley meal ;		
	3 „	„	of ground oats ;
	1 „	„	of pea meal ;
	1 „	„	of meat meal.

At the Athenry centre pea meal was replaced by a similar proportion of bean meal during the last month of the trial.

In addition to the meal mixture, Group I received cooked potatoes and Group II raw sugar beet to appetite. Both groups were fed three times daily throughout the trial. The sugar beet was pulped before feeding at both centres.

At the Clonakilty centre one pig in Group II suffered from an injury and was removed from the experiment in the fifth week. Apart from this the general health of the pigs in both groups was satisfactory. The pigs in Group I put on weight at a greater rate than those in Group II throughout the experimental period. They also had better colour and bloom than those in Group II. During the first week of the trial the average consumption of potatoes by Group I amounted to 5 lb. per pig daily, and a similar quantity of raw sugar beet was consumed by the pigs in Group II. During the last

five weeks of the trial the pigs in Group I consumed on the average 17.5 lb. of potatoes per head daily while those in Group II consumed 15.5 lb. of raw sugar beet.

At the Athenry centre both groups made similar progress during the first month of the trial but subsequently Group I increased in weight more rapidly than Group II. The general health of the pigs in both groups was satisfactory throughout the experimental period, although the pigs in Group I had cleaner skins and presented a healthier and better appearance than those in Group II. The Group I pigs rested satisfactorily between feeds while those in Group II were inclined to be restless. In the first week of the trial the pigs in Group I consumed on the average 6.5 lb. of potatoes per pig daily, while those in Group II consumed 6.7 lb. of raw sugar beet daily. The consumption of potatoes and beet increased progressively throughout the period of the trial and during the last five weeks the average daily consumption per pig amounted to 13.3 lb. of potatoes in the case of Group I and 13.7 lb. of raw sugar beet in the case of Group II.

Particulars of the progress of the pigs at each centre are given in the following Tables :—

TABLE I.

CLONAKILTY CENTRE.

Group	No. of Pigs	Average Initial Weight	Average Final Weight	Average Live Weight Increase	Duration of Trial	Average Daily Live Weight Increase per Head	Average Dead Weight	Dead Weight per cent. of Live Weight
		c. q. lb.	c. q. lb.	c. q. lb.	days	lb.	c. q. lb.	per cent.
I	6	0 2 21	2 0 14	1 1 21	112	1.43	1 2 13	76
II	5	0 2 19	1 3 6	1 0 15	112	1.13	1 1 13	75.9

TABLE II.

ATHENRY CENTRE.

Group	No. of Pigs	Average Initial Weight	Average Final Weight	Average Live Weight Increase	Duration of Trial	Average Daily Live Weight Increase per Head	Dead Weight	Average Dead Weight per cent. of Live Weight
		c. q. lb.	c. q. lb.	c. q. lb.	days	lb.	c. q. lb.	per cent.
I	6	0 2 24	2 0 24	1 2 0	131	1.28	1 2 20	75.7
II	6	0 2 24	1 2 8	1 0 12	131	.95	1 1 15	75.7

It will be observed from Table I that at Clonakilty the pigs to which potatoes were fed (Group I) made fairly satisfactory progress, while the pigs fed on raw sugar beet (Group II) made relatively poor progress, the average daily live weight gain amounting to only 1.13 lb. per pig.

The results obtained at Athenry and which are set out in Table II, show that the potato-fed group (Group I) made considerably better progress than Group II at this centre also.

The quantities of food required to produce 1 lb. live weight increase in both groups at Clonakilty and Athenry are shown in Table III. It will be seen from this Table that at both centres a greater quantity of meals, and in addition a greater quantity of raw sugar beet than of potatoes, were required to produce 1 lb. live weight increase in Group II than in Group I. These results show the superiority of cooked potatoes over raw sugar beet as a food for pigs.

TABLE III.

Centre	Group	Quantities of food required to produce 1 lb. live weight increase
Clonakilty	I	8.6 lb. potatoes + 2.67 lb. meals*
	II	9.7 lb. raw sugar beet + 3.39 lb. meals*
Athenry	I	8.3 lb. potatoes + 2.22 lb. meals
	II	11.2 lb. raw sugar beet + 2.97 lb. meals

*Meal equivalent of separated milk included.

When the trial was completed the pigs at both centres were disposed of to a bacon factory. The report received from the factory indicated that the bacon produced from Group I at Clonakilty was of excellent quality, the fat being firm and dry and the sides had good thick bellies. The bacon obtained from Group II (sugar beet group), although good did not attain the standard of Group I. The fat was firm but not quite so dry and the bellies were not quite so thick. The bacon obtained from both groups at the Athenry centre was described by the curers as " all firm bacon."

The results obtained in these trials show that, when pigs are limited during the fattening period to a maximum allowance of 3 lb. of meals per head per day, raw sugar beet fed to appetite compared unfavourably with cooked potatoes similarly fed. The results also show that, apart from the relatively unsatisfactory progress made by the pigs receiving raw sugar beet, this material appeared to be quite palatable and did not produce any digestive disturbances during the period of the trials.

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INVESTIGATION INTO THE PROBLEM OF MILK

WITH A LOW CONTENT OF SOLIDS-NOT-FAT.

By

D. B. O'LOUGHLIN, M.Sc., and J. J. RYAN, M.Sc., A.R.C.Sc.I.

(Department of Dairy Chemistry, University College, Cork).

Where milk is a staple article of diet, regulations as to its composition have usually been set up with the object of preventing the sale to the consumer of milk which is not genuine. In this country they are based on presumptive limits of 3 per cent. fat, and 8.5 per cent. solids-not-fat (1) which control respectively the two chief forms of adulteration, skimming and watering.

The fat content has received much more attention than the solids-not-fat. This is due mainly to the fact that fat is the more valuable constituent and also owing to the simple mechanical methods of accurately determining its content. Detection of watering by determination of solids-not-fat is unfortunately less satisfactory. Investigations in other countries have shown that perfectly genuine milk from individual cows and even the mixed milk of a number of cows may contain less than 8.5 per cent. solids-not-fat much more frequently than anticipated. A perusal of the literature reveals that many factors may in varying degrees contribute to such incidence of low solids-not-fat. Amongst these are—breed and individuality of the cow, seasonal variations, feeding, presence of mastitis, etc.

As low solids-not-fat, then, is not a universally satisfactory criterion of watering, a number of alternative types of determination based on the ash, lactose, chloride, refractive index or combinations of these and sometimes other constituents have been suggested from time to time in order to distinguish between genuine milk initially low in solids-not-fat and milk in which low solids-not-fat results from watering. Up to the present the most satisfactory single determination for this purpose is that of the freezing point, now employed officially in many countries.

SCOPE OF PRESENT INVESTIGATION

Owing to the detection by the public authorities, particularly in recent years, of frequent cases of solids-not-fat in the milk offered for sale, it was

suggested by the Department of Agriculture that it would be desirable to make a survey of the solids-not-fat position for Irish milks. In carrying out this survey it has been decided to obtain data on :—

(a) The incidence of low solids-not-fat in the milk of individual cows and in the mixed milk of herds.

(b) The value of the freezing point method for normal milk and for milk of low solids-not-fat with a view to establishing a minimum figure, for assessing the genuineness or otherwise of samples of Irish milk.

(c) Comparison between the freezing point determination, as usually carried out, and the approximate freezing point calculated, indirectly from the chloride content and refractive index, with a view to providing an alternative and fairly simple indirect analytical method of detecting adulteration by watering where a proper freezing point apparatus is not available.

(d) Corrolation of low solids-not-fat with the incidence of mastitis.

(e) Possible correlation between the presence of mastitis and certain chemical data such as high chloride, low casein number, etc., with a view to ascertaining the value of these relatively simple chemical methods for the detection of this type of infection.

(f) The influence of factors such as age ; stage of lactation ; feeding, etc. on the composition of milk.

Clearly the programme set out above would take considerable time to carry out in full. As some of the interim results obtained last year mainly on sections (a), (b) and (c), appear, however to be of interest it has been decided to make the work available as far as it goes.

The present preliminary work then summarises the information so far available on these points from an examination of 1070 samples of milk. In all cases the fat and solids-not-fat were determined and for a number of samples the freezing point obtained directly by the Hortvet apparatus and also calculated from the chloride and refractive index. A beginning was in addition made on sections (d) and (e), but owing to circumstances it was impossible to obtain sufficient bacteriological data last year on the incidence of mastitis in low solids-not-fat samples to warrant inclusion here. The work under this head is being carried on this year with the assistance of the Department of Dairy Bacteriology and it is hoped to report upon it and also on (f) at a later date.

LITERATURE

An examination of the literature dealing with the aspects under discussion here, is included for completeness.

Work by Tocher (2) revealed that about 24 per cent. of the milk from individual cows and as much as 6.7 per cent of the mixed milk of small herds (5 cows) failed to reach the standard of 8.5 per cent. solids-not-fat.

Cranfield, Griffiths and Ling (3) examined during 1925 and 1926 700 samples of milk from 15 herds and found that 12 herds gave milk containing less than 8.5 per cent. solids-not-fat on one or more occasions, the highest percentage of deficient samples recorded for any one herd being 40. Cranfield (4) found that at least one-third of the cows in a herd of 30-35 shorthorns produced milk below the minimum standard in solids-not-fat on a considerable number of occasions. He also records very low solids-not-fat (7.38 per cent. morning and 7.23 per cent. evening) for the mixed milk of this herd on one occasion, when the cows were out on a wet aftermath. Cranfield (5) refers to the severe drought of 1929 which caused a burning up of the pastures and resulted in the bulked milk of some herds falling below the legal standard. Nicholson and Lesser (6) carried out an investigation on about 5,000 samples of milk from Fresian cows and found 64 per cent. were deficient in solids-not-fat.

They also observed that the solids-not-fat content of evening milk was generally lower than that of morning milk. Burr (7) examined about half a million herd samples of milk and found about 11 per cent below the minimum of 8.5 per cent. solids-not-fat. He obtained higher percentages of solids-not-fat from farms where supplementary foods were used in Summer, where the conditions of the cows was good and where the incidence of mastitis was low. Houston (8) investigating the question of low solids-not-fat in Irish milks, named the two chief responsible factors as, season of the year, and individual cows giving milk of poor quality.

The observations of many workers, notably Foot and Shattock (9), Rowland and Zein-el-Dine (10), gives support to the view that the presence of mastitis is to a high degree associated with low solids-not-fat. A survey of the literature dealing with this aspect of the matter will be included in a future paper.

The freezing point has already been referred to as in use in many countries for the detection of watering. Its superiority to other determinations as a means of assessing the genuineness or otherwise of milk resides in the fact that it is a physiological constant, like the body temperature, practically independent of the individuality of the animal for the same race ; it measures in fact the osmotic pressure of the milk, and as this fluid is in osmotic equilibrium with the blood of the secreting animal, the freezing point thus provides

an indirect measure of the osmotic pressure of the blood of the animal—an obviously physiological constant.

The literature records enormous numbers of freezing-point determinations. Hortvet (11), in 1919-20 examined 60 milks from individuals cow and found values ranging from –0.534°c. to –0.562°c. with an average of –0.547°c. Monier Williams (12) obtained a " true corrected " average figure of –0.537°c. corresponding to a Hortvet figure of –0.553°c. E. M. Bailey and his collaborators (13), from an examination of the milk of 179 individual cows and 61 herds found values for the individual cows varying from –0.530°c. to –0.566°c. and for the herds from –0.530°c. to –0.562°c. (see Richmonds Dairy Chemistry, 4th Ed.). Eldson and Stubbs (14), obtained an average of –0.544°c. from 1,000 samples of milk. Ryan and Pyne (15), obtained figures for Irish milk ranging from –0.533°c. to –0.568°c. Golding, Mackintosh and Mattick (16) found the freezing point range of –0.540°c. and –0.555°c. Filipo (17), of the Netherlands carried out freezing-point determinations on thousands of samples and found a normal depression in all cases. From these and other figures the average freezing point may be taken as –0.55°c. with a minimum value of –0.530°c.

Experimental.

The value for solids-not-fat obtained in the present investigation from 573 samples of individual cows milk and 496 samples of the mixed milk of herds are summarised in Tables I and II respectively.

TABLE I.

Milk of Individual Cows.

Month	Number Tested	% Below 8.5% S.N.F.	% Below 8.3% S.N.F.	% Below 8.0% S.N.F.
December, 1941 ..	46	17.4	13.0	8.7
January, 1942 ..	33	21.2	3.0	3.0
February ,, ..	38	23.7	15.8	5.3
March ,, ..	18	16.7	11.1	5.5
April ,, ..	21	14.3	9.5	4.8
May ,, ..	58	17.2	15.5	10.3
June ,, ..	88	13.6	6.8	4.5
July ,, ..	65	21.5	15.4	7.7
August ,, ..	90	13.3	12.2	7.8
September ,, ..	9	11.1	11.1	11.1
October ,, ..	20	10.0	10.0	10.0
November ,, ..	47	12.8	10.6	8.5
December ,, ..	40	22.5	20.0	10.0
Total ..	573	16.8	12.0	7.3

TABLE II.

MIXED MILK OF HERDS.

Month	Number Tested	Average No. of Cows in Herd	% Below 8.5% S.N.F.	% Below 8.3% S.N.F.	% Below 8.0% S.N.F.
December, 1941 ..	10	5	5	0	0
January, 1942 ..	22	3	13.7	9.0	4.5
February ,, ..	16	3	12.5	6.3	6.3
March ,, ..	24	9	0	0	0
April ,, ..	65	10	4.6	3.1	0
May ,, ..	100	10	2.0	1.0	0
June ,, ..	56	10	3.6	1.8	0
July ,, ..	86	11	1.2	0	0
August ,, ..	57	9	7.0	5.3	0
September ,, ..	—	—	—	—	—
October ,, ..	10	9	0	0	0
November ,, ..	30	9	0	0	0
December ,, ..	20	4	10	10	0
TOTAL ..	496	9	3.8	2.4	0.4

In Table III are given the freezing points of a number of samples, individual and mixed, as obtained by the standard Hortvet cryoscope and also in some cases the corresponding figures calculated from the chloride content and the refractive index by the formulae of Beckel (18). Chloride was estimated by the direct titration method of Drost (19) and the refractive index was obtained on the serum prepared by using copper sulphate as the precipitant (17.5 grams copper sulphate per 100 cc's water and taking 1.5 cc's of this solution to 30 cc's of milk). These two estimations, according to Beckel (18), gives a figure approximating closely to the freezing point. The formulae are as follows :—

$$\frac{\text{B. C. Z.}}{(\textit{i.e.},\ \text{Brechungs-Chlor-Zahl})} = R + 0.06\ (Cl\text{-}100);$$ where
R = Refractive index in degrees.
Zeiss and Cl = mgms. of chlorine per 100 cc's of milk.

$$\Delta \times 10^2 = 54.5 + 1.5\ [(\text{B.C.Z.})-40]$$ where Δ is the freezing point depression in degrees centigrade.

TABLE III.

Freezing-Point Depressions of Low Quality and Normal Milk.

Sample	Fat %	S.N.F. %	Freezing Point °C.	Calculated Freezing Point B.C.Z.
1	3.10	7.92	–.554	–.557
2	3.30	8.60	–.550	–.549
3	2.70	8.50	–.550	–.554
4	3.65	8.58	–.550	–.551
5	3.20	8.55	–.540	–.545
6	4.00	8.59	–.550	–.545
7	3.65	8.75	–.560	–.559
8	2.85	8.18	–.542	–.545
9	3.05	8.15	–.550	–.550
10	2.75	8.50	–.560	–.549
11	3.30	8.62	–.550	–.549
12	3.30	8.03	–.550	–.555
13	3.55	8.69	–.550	–.553
14	3.55	8.60	–.540	–.536
15	2.95	8.73	–.540	–.546
16	3.15	9.02	–.550	—
17	3.40	8.57	–.550	–.558
18	3.25	8.54	–.550	–.555
19	3.80	8.20	–.542	–.540
20	3.85	8.82	–.545	–.540
21	3.20	9.03	–.544	—
22	2.85	8.71	–.536	—
23	2.90	8.84	–.543	–.545
24	3.10	8.89	–.540	–.543
25	3.00	8.79	–.543	–.546
26	3.40	8.82	–.544	–.547
27	3.50	8.72	–.540	—
28	2.95	8.73	–.539	—
29	2.50	8.90	–.544	—
30	2.94	8.73	–.536	—
31	2.60	8.79	–.540	—
32	3.40	8.70	–.540	–.549
33	2.95	8.60	–.540	–.545
34	2.80	8.95	–.550	–.549
35	3.15	8.52	–.560	–.567
36	2.65	7.92	–.549	–.556
37	3.00	8.54	–.552	—
38	3.25	8.69	–.540	—
39	3.30	8.84	–.547	—
40	3.30	8.60	–.550	—
41	3.20	8.70	–.542	—
42	3.55	8.73	–.549	–.557
43	3.65	8.99	–.550	–.557
44	3.15	8.39	–.560	–.558
45	2.50	8.64	–.540	–.538
46	3.45	8.57	–.550	–.546
47	4.30	8.68	–.558	–.564
48	3.60	8.74	–.560	–.559
49	3.05	8.62	–.550	–.556
50	3.35	8.56	–.550	–.555
51	3.10	8.64	–.564	–.574
52	3.30	8.67	–.549	–.552
53	3.05	8.75	–.558	–.564
54	3.20	8.82	–.556	–.554
55	3.55	8.73	–.540	–.536
56	4.10	8.46	–.550	–.555

TABLE III—(*continued*)

Sample	Fat %	S.N.F. %	Freezing Point °C.	Calculated Freezing Point B.C.Z.
57	3.45	8.81	-.548	-.550
58	3.60	8.61	-.540	-.536
59	3.00	8.04	-.543	—
60	2.85	7.55	-.553	-.552
61	3.10	8.95	-.548	—
62	3.40	9.01	-.548	—
63	2.30	9.10	-.550	—
64	2.85	7.55	-.550	-.549
65	3.60	8.49	-.556	-.560
66	2.95	8.86	-.550	-.548
67	2.35	8.25	-.563	-.559
68	2.48	8.51	-.550	—
69	3.68	8.49	-.544	-.553
70	4.15	7.20	-.560	—
71	3.20	8.78	-.558	—
72	3.60	8.68	-.538	—
73	4.85	8.30	-.542	-.551
74	3.20	8.60	-.547	-.547
75	3.20	8.65	-.554	-.556
76	3.70	8.75	-.545	-.547
77	4.50	8.54	-.547	-.550
78	2.65	6.47	-.555	—
79	4.22	8.73	-.544	-.548
80	3.15	8.40	-.540	-.538
81	3.30	8.68	-.540	-.545
82	2.80	8.70	-.540	—
83	2.85	8.67	-.551	-.556
84	3.95	8.35	-.542	-.546
85	3.52	8.56	-.558	-.560
86	2.80	8.50	-.356	-.559
87	3.40	8.70	-.550	-.551
88	3.70	9.13	-.548	-.551
89	4.55	8.68	-.550	-.546
90	4.80	8.60	-.550	-.549
91	1.55	8.83	-.548	-.549
92	3.10	8.64	-.560	-.559
93	3.05	7.50	-.550	-.553
94	3.45	8.33	-.560	-.563
95	3.05	8.75	-.545	-.546
96	3.50	8.59	-.550	-.549
97	2.85	8.71	-.545	-.546
98	3.10	8.01	-.548	—
99	4.10	8.01	-.551	—
100	3.00	8.40	-.552	—

Discussion of Results.

From Tables I and II it can be seen that a fair percentage of the samples of both the individual and herd milks failed to reach the presumptive standard of 8.5 per cent. solids-not-fat. In the case of the milk of individual cows 16.8 per cent. of these did not reach the legal limit in solids-not-fat (cf. Tocher's figure of 24.7 per cent.). In the case of mixed herd milk about 3.8

per cent. of these failed to reach the minimum of 8.5 per cent. solids-not-fat. Tocher (2) found that about 6 per cent. of the milk of herds of 5 cows were below this figure. Comparison with figures from other countries are not, however, very instructive since the composition of milk is influenced by many factors, which vary from country to country. The Tables also show that in many cases the milk was considerably below the legal standard. In the case of individual milks some 7 per cent. showed solids-not-fat of less than 8 per cent., while only 0.4 per cent. of the herds examined gave milk below this figure.

For mixed herd milk the percentage below 8.5 per cent. solids-not-fat during the winter months were much greater than at other times of the year. This is very probably due mainly to the small number of cows (average 3 cows) in many of the herds tested at this time of year. The possibility of a low level of nutrition proving to be a factor cannot, however, be excluded.

A number of cows were followed throughout the greater part of the period, and many of these gave milk consistently low in solids-not-fat. Three were found to be below the standard on all occasions in both fat and solids-not-fat, one of these, *e.g.*, giving a range of 6.37 per cent. to 8.25 per cent. in solids-not-fat. Subsequent examination by the Bacteriology Department showed the presence of mastitis organisms in the milk of all three.

Freezing Point.

The figures obtained from 100 samples of milk, some of low solids-not-fat, submitted to the freezing-point tests are shown in Table III. The results are a further indication that the freezing point of poor quality but genuine milk differs only very slightly, if at all, from the average for milk of normal composition, *viz.*, –0.55°c. The figures include milk from individual cows (Nos. 59 to 100) and mixed milk (Nos. 1 to 58) and the close agreement between them demonstrates the value of the test. The freezing-point figures obtained all lie between –0.536°c. and –0.564°c., that is, the maximum variation from –.55°c. is plus or minus .014°c., a figure well within the limits ascertained by workers in other countries.

The B. C. Z. Determination.

As a matter of interest, the refractive index and chloride test were carried out on some samples (already submitted to the freezing-point test) and therefrom by the formulae of Beckel (18) a theoretical freezing point was calculated. The values obtained in this way show close agreement with the actual freezing-point figures, and the method thus furnishes a satisfactory and convenient alternative procedure for the detection of added water when the freezing-point method is not available.

SUMMARY.

1. It has been shown that under normal conditions of management, etc., the milk of both individual cows and of herds failed to reach the minimum requirements in solids-not-fat on many occasions. Thus :—

(*a*) Of a total of 573 samples of milk from individual cows 16.8 per cent. were found deficient in solids-not-fat.

(*b*) Of a total of 496 samples of composite herd milk (average size 9 cows) 3.8 per cent. failed to reach the presumptive standard in solids-not-fat.

2. Data have been given which confirm the value of the freezing point method for the recognition of genuine milk, even in the case of poor quality milk, which falls below the legal limit for solids-not-fat.

3. A number of theoretical freezing point figures were calculated from the chloride and refractive index by the formulae of Beckel. These approximate very closely to the actual freezing point as determined by the Hortvet apparatus, suggesting that this procedure may be used to detect watering as an alternative to the freezing point method where this is not available.

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THE MORE IMPORTANT POISONOUS PLANTS OF THE FARM.

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Poisonous plants are not, perhaps, to be regarded as one of the major causes of losses among our live stock. How great the extent of the losses they do cause and what proportion of the fatal illnesses among cattle and other farm animals should properly be attributed to poisonous plants are questions which cannot be easily or accurately answered. It is not unlikely that a careful survey would reveal losses and injuries of quite serious dimensions. As it is, definitely established cases of poisoning are frequently met with. This is proved by clinical and especially by post mortem examinations of affected animals. Leaves and other parts of plants known to have toxic properties are often recovered from the stomachs of animals that have died under circumstances suggestive of poisoning. In many, perhaps most, cases of poisoning, or rather of suspected poisoning, the evidence is not conclusive. The symptoms are not clear and post mortem examination fails to give a definite result. Again, not every animal that eats portions of poisonous plants dies. If less than a certain amount of the plant is eaten the animal, after a more or less severe illness, may recover. The effect on the animal may be slight but, on the other hand, considerable injury to health may be the result and a long interval may elapse before such an animal is fully restored to its normal thrifty condition. In many cases of this kind the true cause of the trouble may remain entirely unsuspected. Worms may be blamed, or an internal injury, or the beast may be said to have a "murrain." Murrains are often believed to come from "something in the land." It is not improbable that this something could, in some cases at all events, be traced to an unwholesome or poisonous plant.

Poisonous plants are not, indeed, rare or uncommon in our pastures, hedges, shrubberies, waste ground and other situations to which animals have more or less constant opportunities of access. Why there are not more frequent accidents and losses is due essentially to the instinct of the grazing animal which is a reliable guide as to what plants may be eaten and which ones should be avoided. Many, probably most, of our plants are provided with some sort of protection against grazing animals. Thus, there are hairs on the leaves and stalks (even hairy grasses are disliked), spines, thorns, prickles and other mechanical safeguards. Other plants are protected by acrid substances in their tissues or a bitter sap which renders them unpalatable. Besides these there are still other plants which are for no apparent

reason shunned by grazing animals. Some, at least, of the last group are poisonous. It is, therefore, this instinctive power of selection, enabling animals to choose what is wholesome and avoid plants that are dangerous that affords the most effective protection against accidents.

There are times, however, when the instinct fails. Animals in bad health often develop a depraved appetite and are then liable to nibble and graze, with harmful consequences, plants they would not normally touch. In this way many losses from poisoning occur. Again when fodder and grazing are scarce, as is not uncommonly the case in late spring, or at the end of a drought, animals compelled by hunger will, in spite of the warnings of instinct, consume practically anything that may be available. It is under these circumstances that some of the most serious losses from poisoning take place. In hill pastures, for example, the young fronds of bracken which often come up in abundance before grass has made any substantial amount of growth have been known to cause deaths among cows and other live stock.

There are over a thousand different species of flowering plants—trees, shrubs, grasses, herbs—and ferns that grow wild in this country, and the great majority of them are at sometime or another accessible to live stock. As is well known animals do not confine their grazing to the grasses, clovers and miscellaneous plants that constitute the ordinary herbage of pastures. Trees and shrubs are freely browsed upon and, incidentally, often seriously damaged in consequence. In rough pastures furze, heather, brambles, whitethorn and other shrubby species are more or less freely grazed especially when a more succulent bite is not available. Under certain circumstances live stock will browse upon most kinds of trees, shrubs and herbs, many of which, as has already been mentioned, if consumed in sufficient amount, would be definitely harmful and in certain cases even deadly.

It would be difficult and not particularly useful for the present purpose to prepare an annotated catalogue of all the plants of farms, gardens, shrubberies and other situations which are known to possess harmful properties. As the main object in view here is to provide stockowners and farmers with information regarding those plants which are usually responsible for accidents and losses the scope of this article will be somewhat limited and confined, in fact, to notes on a score or so of those species which past experience in this country and elsewhere has shown to be most important. In dealing with these, restricted in numbers though they are, some scheme of classification is necessary. The usual practice is to treat the plants in regular order according to the families to which they belong, *i.e.*, according to their botanical relationships. That method is unquestionably a good one, especially if an attempt is being made to treat of the subject exhaustively. For the present purpose it is felt that a more satisfactory arrangement is to group the poisonous plants of the farm according to the situations in which they are usually found growing. Thus there are poisonous plants of (A) *Pastures and Meadows*,

(B) *Ditches, Streams, Marshes, Rivers, Canal Banks,* (C) *Hedges, Plantations, Shrubberies,* (D) *Tillage,* (E) *Waste Ground, Rubbish Dumps, Ruins, Roadsides, etc.*

A.—PASTURES AND MEADOWS :

The sward of an old pasture often contains as many as forty or fifty species of grasses, clovers, and miscellaneous herbs, all intimately intermingled. A beast grazing, therefore, is compelled to a great degree to take everything as it comes. While this is in the main true it may be observed, if animals are watched as they graze, that a considerable amount of selection is exercised. Certain species appear to be shunned with the result that they tend to increase and become a dominant and conspicuous feature of the sward. Hence it is that in late spring and early summer many of our pastures show such a remarkable crop of buttercups. They are unpalatable and remaining unchecked, they go on increasing from year to year. The idea that buttercups are a sign of a good pasture or that they give a rich colour to butter is erroneous.* Not only are they useless weeds but some of the species are severely poisonous.

BUTTERCUPS (*Ranunculus spp.*)

There are three species of buttercup common in pastures : (*a*) CREEPING BUTTERCUP (*Ranunculus repens*) so-called because of its mode of propagation which is similar to that of the strawberry. This species is believed not to be poisonous. (*b*) BULBOUS BUTTERCUP (*Ranunculus bulbosus*), a rather tall upright species having no runners but the base of the stalk just below the surface of the ground is enlarged to form a small white fleshy bulb. It is often the main species in a pasture heavily infested with buttercups and it is the most poisonous of the ordinary pasture species. (*c*) COMMON OR ACRID BUTTERCUP (*Rannunculus acris*) is rather like the Bulbous in its form and general appearance but it has no bulb. Neither has it any runners. It, too, is poisonous. It appears that the buttercups are less poisonous while the leaves and shoots are growing. The most dangerous time is when the plants are flowering and the flowers themselves are the most poisonous part. Luckily the toxic principle is volatile and disappears when the plants are dried so that in hay buttercups are usually believed to be harmless.

RAGWORT, BOOKALAWN, OR BEN WEED (*Senecio Jacobea,* and other species).

This weed becomes extremely abundant in pastures that are overgrazed, and in other respects mismanaged. It is often plentiful in meadows too.

It is shunned by cattle and horses. Sheep, on the other hand, graze it. They are, in fact, helpful in keeping the weed under control and do not, it seems, suffer any injury from eating it, provided it does not form a very high proportion of their diet. With cattle the position is different. For them

* The rich *yellow* colour of butter in early summer is due to a pigment derived from *green* herbage.

Ragwort is distinctly poisonous and in hay, especially, it is highly dangerous. In a number of cases investigated by Bisset and Rees in Wales a few years ago, the deaths of several cattle (eighteen on one farm) were definitely proved to be caused by hay containing Ragwort. The action of this weed is peculiar. The symptoms may not appear while an animal is actually being fed on hay containing Ragwort or for some time after its use has been discontinued.

The effect of the poison is cumulative and before the symptoms develop a "latent period" which appears to vary from three weeks to six months must elapse. Once the symptoms—staggering gait and diarrhœa with severe straining—have appeared, no treatment tried so far has been of any avail in curing the animals. The characteristic post mortem features of Ragwort poisoning are: yellow and hardened ("cirrhotic") liver, large quantity of bile in the gall bladder, and thickened lining of the fourth stomach.

Autumn Crocus or Meadow Saffron (*Colchicum autumale*).

This extremely poisonous plant of marshy meadows and pastures is fortunately rare in Ireland. At present it is known to occur only in Co. Kilkenny where it is said to be frequent in the Nore Valley The pale, purplish pink flowers appear in early autumn, but the seed vessel which develops underground in the base of the flower does not appear until the following spring when it is carried up on a stalk accompanied by the dark green leaves which are broadly lanceolate, 1 inch to 1½ inches wide and from 6 inches to nearly a foot long. All parts of the plant are poisonous whether they are grazed in the green condition or dried in hay and wherever it is found steps should be taken to eradicate it by digging up the bulbs or, as they are more correctly termed, corms.

Bracken (*Pteris aquilina*).

The Bracken fern covers very large areas of hill pasture, and other types of rough grazing land where the soil is fairly deep and well drained and the situation more or less sheltered from the strongest winds. It frequently invades pasture fields and meadows, encroaching from the fences by means of its powerful underground runners or rhizomes. While there appears to be some difference of opinion regarding the toxic properties of Bracken, reports from reliable sources in this country, besides numerous records of cases investigated in Canada, the United States and other countries abroad, leave no doubt that both the fronds and "roots" (rhizomes) of this fern are harmful and may be the cause of serious losses among live stock. Fortunately, if a reasonable amount of pasturage is available healthy animals with normal appetites will, as a rule, avoid bracken. Losses generally occur either in spring when the fronds are just coming up and grazing is not yet plentiful or in the autumn when pastures have again become bare. Hay containing an appreciable amount of Bracken should be regarded as dangerous.

B.—DITCHES, STREAMS, RIVER AND CANAL BANKS, MARSHES AND OTHER WET PLACES.

Celery-Leaved Buttercup (*Ranunculus sceleratus*).

This is probably the most poisonous of the buttercups. It is an annual upright-growing species having very small (about $\frac{1}{4}$ inch in diameter) yellow flowers. It is found only where the ground is damp, say, beside streams, in wet pastures and about the edges of pools or ponds. It is stated that cattle have frequently been poisoned by this plant.

Lesser Spearwort (*Ranunculus Flammula*).

This species which has yellow flowers like the pasture buttercups has narrow-pointed smooth leaves. It is very common in moist places—along the banks of streams, in ditches, around springs and drinking places. It must be regarded as a poisonous plant. Though it is rarely grazed—in quantity at all events—poisoning of animals has been attributed to it.

Marsh Marigold or King Cups (*Caltha palustris*).

This well-known species with its handsome large yellow flowers is more or less poisonous and the loss of animals from eating it has been recorded in Germany. It is rarely, if ever, grazed by healthy animals.

Water Dropwort (*Oenanthe crocata*).

This and the following species belongs to the family, *Umbelliferæ*, of which carrot, parsley, celery and parsnip are familiar examples, Species belonging to this family are readily recognised by the form of their flowering branches. The leaves also of many of them bear a strong family resemblance to one another, being finely divided as in the carrot. This Dropwort is not uncommon in wet ditches or river banks and often in the beds of rivers usually in districts where the ground lacks lime. It is frequent throughout County Wicklow for example, but it has not yet been noticed in Leix, Offaly, Kildare, Westmeath, Longford or Roscommon. The plant is a perennial with several stout more or less spindle-shaped fleshy roots. In the early spring a new crop of leaves arises from the crown of the root stock. The leaves resemble celery somewhat and have been eaten in mistake for this vegetable with fatal results. Each season stout, branched stems, grooved on the surface, hollow inside and reaching 4 or 5 feet in height grow up from the root stock and come into flower during June and July. The sap of both the stem and the roots turns yellow when exposed to the air. All parts of the plant, especially the tuberous roots, are poisonous and death may follow within a few hours after eating it. In cleaning out ditches in the winter and spring there is a possibility that the tubers may be thrown out on the bank Cattle are liable to eat them and cases are known in which poisoning has occurred in this way.

Cowbane or Water-Hemlock (*Cicuta virosa*).

This species is confined mainly to the North of Ireland and, outside a few areas, is quite rare. In its known distribution it lies between two lines drawn from Galway, one to Derry and the other to Dublin. It grows in ditches, ponds and other wet places. It is a perennial, having a stout tap root which is hollow and divided by cross walls into a number (maybe six or eight) cavities. The root has a sweetish taste. It has been mistaken (with fatal results) for celery or parsnip. The main stem reaches 4 feet in height. The flowers which are borne in umbels in the manner characteristic of the family are small and white and appear from June to August. Like Dropwort, Cowbane is poisonous in all its parts. It is not usually eaten by stock unless herbage is scarce. As with Dropwort, it is dangerous to throw out the roots on the bank when ditches are being cleaned.

Horsetails (*Equisetum spp*).

These plants form a small group of plants which are related botanically to the ferns. In Ireland there are about ten different species and of these three or four are widespread and common. Horsetails have upright, somewhat rush-like, stems which are grooved on the surface, distinctly jointed, and hollow inside. At each joint or node of the stem there is a sheath. Branches, when present, arise in whorls from inside the sheath. As in ferns, reproduction is by spores—not seeds. The spores are borne in cone-like structures which form on the tips of some of the stems. In certain of the species, *e.g.*, the Field Horsetail (our commonest species), the spores are produced on special, unbranched brownish (not green) stems which come up early in the spring before the green infertile shoots appear. Propagation is mainly by underground runners which develop extensively and make eradication difficult. Horsetails occur typically in damp soils and are often an abundant constituent of the herbage of marshy ground. The Field Horsetail is a common and frequently troublesome weed in tillage or damp soils. The shoots of Horsetails are rough and unpalatable and not normally eaten freely by live stock other than horses. There is a considerable amount of evidence from different sources that the plants are poisonous, different species in different degrees. While they are not in ordinary circumstances to be regarded as very dangerous, at the same time it must be remembered that authentic cases of death from Horsetail poisoning are recorded for both cattle and horses and the presence of the plants, therefore, among herbage and fodder is highly undesirable. Growing in the pasture the green plant is not likely, perhaps, to cause serious trouble. Hay from marshy meadows may, however, contain enough of the weed to make it definitely unwholesome, or even dangerous, especially for horses.

C.—HEDGES, PLANTATIONS, SHRUBBERIES.

Yew (*Taxus baccata*).

This well-known evergreen tree or shrub (it grows very slowly) is perhaps the most dangerous of our poisonous plants. It probably causes more deaths among our livestock than any other species.

Though indigenous in Ireland Yew trees are now rarely met with except where they have been planted. From the earliest times they have been planted in the precincts of churches and religious houses, and some of the oldest trees in the country are now growing on the sites of ancient monasteries. The tree is often planted in shrubberies. All parts—wood, bark, twigs, leaves, seeds (but not the scarlet cup or " berry " which surrounds the seed)—are poisonous, the old leaves and shoots being especially so. Clippings are very dangerous and have been responsible for many losses. It is recorded that sheep have died from eating in April clippings that lay on the ground since the previous autumn.

Yew, unlike so many other poisonous plants (which are unpalatable, or otherwise unattractive), is readily eaten by cattle, sheep, horses and other domestic animals. For that reason the strictest precautions should be taken to prevent live stock having access to it. Care should be taken, for example, lest animals reach and nibble Yew trees across a pasture fence. It should be remembered, too, that the owner of a Yew tree may be liable for compensation if graziers on his land or his neighbour's animals in an adjoining field should get poisoned by it. It is obvious that farmers should never plant Yew as an ornamental evergreen.

LABURNUM (*Cytisus Laburnum*).

This ornamental tree, or shrub, of the pea family producing its long, drooping racemes of yellow flowers in May and June, is fairly common in gardens and pleasure grounds and, according to one authority is " certainly one of the most poisonous of all trees cultivated in gardens." All parts are poisonous, especially the seeds which are formed in pods, like peas, and are often produced in great quantity. Children have frequently been poisoned by them. Among live stock horses, it is stated, are much more susceptible to injury by Laburnum than are cattle. Laburnum should not be planted in positions where grazing animals are likely to have access to it.

RHODODENDRONS (*Rhododendron ponticum* and other species).

Though poisoning by Rhododendron is probably rare, it is well to bear in mind that the plants possess poisonous properties and there is, therefore, a certain amount of risk, greatest when herbage is scarce, where animals have access to this shrub. In some situations where it was formerly planted *Rhododendron ponticum* has spread rapidly and is now covering fairly extensive areas.

BITTER-SWEET or WOODY NIGHTSHADE (*Solanum Dulcamara*).

This species, a member of the potato family (*Solanaceæ*) is found here and there in hedges throughout Ireland. Nowhere in the country, however, does it occur in abundance; actually outside County Dublin, where it is fairly common, its occurrences generally appear to be few and far between. The flowers are purple, somewhat smaller than, but otherwise resembling

closely, those of potato. The somewhat oval berries are bright red or scarlet, when ripe. The stem, leaves and berries, contain the toxic substance, solanine. Bitter-sweet has been known to cause poisoning in sheep and cattle.

Note.—Besides those just referred to, many plants, occurring more or less commonly in hedges, woods and shrubberies, possess poisonous properties. Among trees, mention may be made of the OAK. The leaves and, for some animals, the acorns are poisonous or, at least, unwholesome.

SPINDLE TREE (*Euonymus europœus*)

This is poisonous in all its parts, its brightly-coloured berries especially so.

Among HERBS, mention may be made of FOXGLOVE (*Digitalis purpurea*), WILD ARUM (*Arum maculatum*), (bright red berries very poisonous and dangerous for children), LESSER CELANDINE (*Ranunculus Ficaria*), ST. JOHN'S WORT (*Hypericum spp.*), and HEDGE PARSLEY (*Chœrophyllum sylvestre*). Though live stock constantly have opportunities of grazing these the risk of injury is not great mainly for the reason that the plants are unpalatable and are, therefore, under ordinary circumstances avoided.

D.—TILLAGE.

CORN COCKLE (*Lychnis Githago*).

This annual weed of cornfields has been noticed in nearly every county in Ireland. It occurs more frequently in the East, South, and Southern Midlands. It is a tall (3-4 ft. high), rather robust plant, and among corn it is conspicuous by reason of its large (1¼-1½ inch across) purple flowers. The seeds, borne in capsules on the tips of the branches, are large, black, angular, kidney-shaped and rough, with concentric rows of pointed tubercles. As they are about the same size as grains of corn they are, with difficulty, removed by screening. Consequently, when Corn Cockle grows as a weed in a crop of wheat or other cereal, some of the seeds (which are poisonous) are almost sure to be found among the grain. In such cases there may also be substantial amount of the seed in the screenings.

From the earliest times Corn Cockle has had the reputation of being poisonous. Numerous cases are on record in which it has been held to be responsible for poisoning in humans and domestic animals. It is true that trials have shown that large quantities of Cockle seed may be eaten by pigs and other animals without injury, a fact which may be explained by differences in the amount of poisonous substance in different lots of seed according to the season and possibly also according to soil in which the plant grows.

Apart from whatever poisonous properties it may possess, Cockle in wheat is always objectionable as, if present in sufficient amount, the ground-up seeds discolour flour and give bread a disagreeable odour.

Fortunately, at the present time, the extent to which Cockle contamination occurs in Irish grain is very slight, probably negligible. Very few samples contain Cockle seeds and when they do the quantity is usually very small. Samples of wheat and barley containing about twenty seeds to the pound weight, have been met with. From the point of view of the wholesomeness of the grain, such a slight contamination is hardly significant. It would be most unwise, however, to use such grain for seed as, if sown at the rate of 16 stone to the acre, it would mean a seeding of about 1 seed to the square yard of corn cockle with the likelihood of a greatly increased and probably dangerous Cockle content in the resulting crop. Proper rotations and clean seed are the best means of keeping Corn Cockle in check.

Among other poisonous weeds of tillage may be mentioned POPPIES (*Papaver spp.*), SPURGES (*Euphorbia spp.*) and PRESHAUGH (*Sinapis arvensis*) all of which occasionally occur in great abundance in catch crops or other green fodder. Live stock are not at all likely to graze Poppies or Spurge, but there is, perhaps, some risk in feeding to young stock, green fodder containing a lot of Poppy. The Poppy heads containing the seeds are the most poisonous part and stock have, it is known, been injured by eating these.

In the case of Preshaugh, too, it is the seeds that are especially poisonous, a point which it is important to bear in mind as the seed often forms a high proportion of the cleanings of cereals. Such materials containing Poppy heads and Preshaugh seeds, if ground up and used as feeding stuffs, are likely to be quite harmful.

WHITE MUSTARD (*Sinapis alba*).

A species closely related to Preshaugh is sometimes sown for green manuring. The seeds of this plant too, are dangerous and there are records of sheep having been lost as a result of grazing the growing crop in the seeding stage.

BLACK MUSTARD (*Sinapis migra*).

The seeds of which are used in the manufacture of table mustard must also be regarded as dangerous in the seeding stage.

E.—WASTE GROUND, RUBBISH DUMPS, RUINS, ROADSIDES, ETC.:

HEMLOCK (*Conium maculatum*).

This intensely poisonous member of the Umbelliferæ (carrot-parsnip family) occurs throughout Ireland. It is generally more plentiful near the sea and is commoner near villages than in the open country. It is tall (3-5 ft.) with a stout, smooth, somewhat furrowed, hollow stem which is almost invariably splotched or spotted with purple. The leaves are large and finely divided into small toothed segments. The numerous small (⅛-inch across) white flowers are borne in large umbels. When bruised, the plant emits a nauseous odour.

Cases of human poisoning have occurred when Hemlock has been eaten in mistake for other herbs, *e.g.*, parsley. On account of its unpleasant odour it is rarely eaten by live stock in this country. Cases are on record, however, of poisoning of horses, cattle, sheep and pigs, by Hemlock.

Hemlock is an annual or biennial and is, therefore, entirely dependent on its seed for survival and spread. It can and should be eradicated by prevention of seeding.

HENBANE (*Hyoscyamus niger*).

This species, a member of the potato family and poisonous in all its parts, is rather rare in Ireland. There are several counties from which it has not yet been recorded. It is an annual or biennial and grows typically in sandy ground. It is rather coarse and branching, 1-2 ft. high, more or less hairy and sticky or clammy. It has a nauseous smell. The large (over an inch long and up to $1\frac{1}{4}$ inches across) flowers are dingy yellow, streaked with purplish veins. The seeds, small and numerous, are formed in a globular capsule. By reason of its rarity and its unpalatibility Henbane is hardly likely to cause poisoning among live stock.

Two other poisonous species of the Potato family are sometimes found growing in waste places, seldom far away from houses or ruins. They are DEADLY NIGHTSHADE (*Atropa Belladonna*), a perennial, 2-4 ft. high, and BLACK NIGHTSHADE (*Solanum nigrum*), an annual about a foot high, which may also grow as a weed in gardens. As they are both very rare in Ireland, Deadly Nightshade especially so, the danger to live stock is slight. Both these species have black (when ripe) poisonous berries.

In this section reference may appropriately be made to another possible source of danger which, at one time or another, is likely to exist at most farms. It arises when garden refuse is thrown on to rubbish dumps, compost heaps, manure heaps or out on the roadside. The plants thrown out may include some that are poisonous, such as HELLEBORE, MONKSHOOD, LARKSPUR, LILY OF THE VALLEY, all of which are common in gardens. Some of these may even take root and grow for a time. It is not suggested that they are necessarily highly dangerous, but if live stock, especially young animals such as calves, have access to them there is always some risk of poisoning. It is wise, therefore, to dispose of garden refuse containing pieces of ornamental plants, shrub clippings, etc., in such a manner as will place them outside the reach of live stock.

In the foregoing notes the plants which are most likely to be harmful to live stock have been brought under review and the measures which farmers and stockowners should adopt to safeguard their animals have been indicated. It will be seen that direct preventive action, involving the removal and destruction of dangerous and suspicious plants, is often not possible or

practical. In the main, resort must be had to indirect methods having their basis in a knowledge of the biology of the plants and also of the habits and instincts of the animals themselves. The principal precautions to be taken may be summarised as follows :—

1. **Destroy and remove or otherwise get rid of harmful plants.** This is applicable to certain trees and shrubs, *e.g.*, Yew and Laburnum, which as already mentioned, ought not to be planted for ornament in situations where live stock can have access to them. Eradication should be the aim too, in the case of Ragwort and Buttercups in grassland and Corn Cockle in cereals. The most satisfactory, rapid and generally most effective method of ridding grassland of Buttercups is tillage and re-seeding with a carefully compounded mixture either directly after ploughing up or at the end of a rotation. To keep pastures free of Buttercups not only the seeds mixture but also the manuring and management of the grazing must receive careful attention. Ragwort is usually abundant on over-grazed pastures and in paddocks. It is a biennial and is, therefore, entirely dependent on its seed for its survival and spread. It can, therefore, be eradicated by persistent pulling to prevent seeding. Sheep are also very useful in keeping down Ragwort as they graze it in the rosette stage with apparently no ill effects on their health. As already pointed out, ragwort is most dangerous in hay.

2. **Provide ample fodder for use in spring when grazing is scarce.** Mortality among live stock is heaviest in spring. There are various reasons for this. Poisonous plants are certainly responsible for some of the deaths that occur at this season. Apart from such as may be caused by Ragwort or other harmful herbs in hay, other losses are due, as has already been pointed out, to animals being driven by hunger to browse on plants which, if adequate food supplies were available, they would carefully avoid.

3. The greatest care should be taken to **avoid gathering up poisonous or suspicious plants among winter fodder.** Buttercups, though useless as fodder, are not, apparently, actually dangerous in hay. Ragwort it may be repeated, is highly so and so also is Bracken. One sometimes hears it suggested that practically any sort of green stuff is capable of being converted into wholesome and nutritious silage. This idea (which is quite erroneous) arises from the failure to understand that ensiling is a preservative process—a form of pickling—applied to green fodder that is already wholesome and nutritious, being composed usually of proper herbage plants—grasses, clovers, cereals, legumes, etc. Mowings from the verges of fields, banks, and waste corners may contain harmful species. To convert into silage a crop of, say, ryegrass and clover heavily contaminated with

Poppies, Preshaugh in seed, or Spurge entails a certain amount of risk, depending on the extent and nature of the contamination.

4. It should be remembered that **sick animals often develop a depraved appetite** which may lead them to eat plants they would normally avoid. Care should be taken to ensure that while they are in this state they do not have access to harmful plants.

If an animal falls sick and the nature of the illness is obscure, a veterinary surgeon should be consulted as soon as possible. Should an animal be suffering from poisoning skilled attention may save its life and bring about rapid recovery. If a death occurs the cause may sometimes be ascertained by a post mortem examination. If poisoning is indicated necessary steps to prevent further losses can be taken. Even if the post mortem gives negative results and the cause of death remains uncertain, the land should be examined by a botanist and a thorough search made for poisonous plants.

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LIVE STOCK FEEDING.

Broadcast Talk given by PROFESSOR E. J. SHEEHY, D.Sc., Head of Animal Nutrition Department, University College, Dublin, on Saturday, 11th December, 1943.

As a result of the emergency conditions farmers are now obliged to till a certain quota of their arable land. To many of you this obligation has not necessitated any change in the system of farming because an appreciable proportion of your farms has at all times been tilled. To many others it has meant a necessary change of husbandry. An increase in tillage causes a reduction in grass and meadow land thus, it is claimed, decreasing the area available for livestock feeding.

While talking, a few days ago, to a farmer friend who has ploughed up a good deal of his old pasture since 1939, I asked him if he now keeps less stock than he did pre-war. His reply was encouraging and stimulating. Actually he said : " I keep the same number of cattle, sheep and horses, I have a few more pigs and many more poultry, and while before the war I sold no grain, I now dispose of a good deal of corn about three-quarters of which is wheat." I inquired whether he was smuggling in feeding stuffs or purchasing the produce of his neighbours' farms. " No," he said, " but notwithstanding the shortage of artificial manures, I am now producing on my own farm far more food than I had been doing." " The plough has aided me," he said, " though I took very reluctantly to it." He went on to say that about Christmas, 1939, he ploughed up one of his old grazing divisions which only carried a beast to every 4 or 5 acres, a field which was not producing enough to pay for the rent and rates on it. It gave a very fine crop of oats in 1940, and was grazed in 1941 when it carried more than twice as many stock as it did prior to ploughing. The field was again ploughed at the end of 1941, *i.e.*, after one year's grazing and it bore a very profitable crop of clean wheat in 1942, it gave a good hay crop in 1943 and is at this moment heavily stocked with cattle which are doing well on it. " Encouraged by my success," he said, " I have since been ploughing up some of my smaller fields and putting as many of them through a rotation of tillage cropping as I have been able to manure." Then, with a flourish, he again declared that on much less grazing land, of superior quality, however, he now carries the same amount of cattle and sheep as he did before and from the tilled ground he procures abundance of feeding stuffs for the other farm stock and at the same time cashes in on grain sold off the farm.

The fact is, as illustrated by the instance I have quoted, that there is wide opportunity for increasing the productivity of a high proportion of our pasture land. When improved, a much reduced pasture acreage would carry our population of grazing animals, thus leaving ample arable land for the production, not alone of food for man, but of feeding stuffs for farm stock. The question of feeding live stock in present circumstances, and the conditions of to-day may obtain for a very long time, is primarily one of crop production, the word crop implying both tillage and pasture; and while the solution of the problem lies in taking the plough round the farm—that system of ley farming familiar in so many parts of this country—need I say that there are many snares and pitfalls and much knowledge to be applied in successfully conducting this programme, and need I refer to the advisability of consulting the agricultural advisory staff in preference to gaining the necessary knowledge by repeated failures. As a prelude to a discussion on live stock feeding I emphasise the production of a sufficiency of food on our own land. All types of live stock and live stock products—cattle, sheep, pigs, poultry, horses, milk, eggs and wool, are paying well at the moment, but the total income accruing from them is directly related to the quantity of nutriment made available by food production on the farm. Hence the emphasis, from this point of view, on increased food production from tillage and grass land.

Repeated experiments conducted in this country have established the value of home-grown feeding stuffs for live stock and have shown them to be equivalent in productiveness to any imported material. The experience of farmers during the past three years has confirmed these findings. It is true that there has been a serious decline in the pig population, and a fall in the poultry, but this is explained by a shortage of food rather than by a depreciation in the quality of the diet available. Where properly managed, poultry are laying as well as they were pre-war; pigs are reaching the same weights, and though they take a little longer to mature than they did when maize was freely available the quality of the bacon is superior, a fact which is of considerable importance because, after the emergency, our bacon will again have to compete on the foreign market with the product of other countries; cows are milking as well as before, and the condition of our cattle and sheep is as good as it was. This is the result where, as I have indicated, stock are properly managed, that is to say, where the necessary knowledge, whether gained by experience, or acquired through the advice and instruction of those possessing the knowledge, is applied.

If stock can be as well fed on the limited range of foods now available as they were when a great variety of foods was used, it may appear as if the feeding of live stock was, by those pronouncing on it in the past, made to appear an unnecessarily complex business. Variety and the adoption of a complicated feeding formula do not in themselves render a diet sounder or more complete or satisfactory. There is, however, a code of basic principles underlying the feeding of stock comparable with those underlying human

nutrition and it is the correct application of these which matters. Each type of farm animal has certain food requirements and if these are not supplied, in the correct quantity and in the proper quality, growth and production suffer. Rarely does an animal die because of an unsatisfactory diet just as a complete crop failure is of rare occurrence, but unthriftiness and low productivity, causing enormous losses to our farmers, are, alas, of too frequent occurrence among farm stock. From the foods available to-day, if the diet is properly balanced, the qualitative requirements of all stock can be successfully supplied, but we want more of them.

A properly balanced diet is not, as I have stated, necessarily a complicated one. Let me illustrate from pig feeding : adequate supplies of the very necessary proteins, minerals, vitamin A and vitamin D, and sufficiently concentrated ration to give excellent results are provided to pigs which are housed in a sty into which direct light has access, and which are fed some green food such as cabbage, kale or grass in addition to a mixture of oats, barley, potatoes, and separated milk or, in the absence of separated milk, meat meal. The diet is simplicity itself and one which, of course, has been so successfully used in this country. If, however, the green food is omitted, the important vitamin A is in short supply and the pigs are unthrifty and unprofitable. Similarly the essential vitamin D, which prevents cramp, stiffness and the scurfy oily skin which are some of the symptoms of a rickety condition, must be provided in order to promote normal growth and fattening. Direct light to the interior of the pig house or to an adjoining yard is essential to provide the vitamin D. Pigs otherwise housed return only half profit unless cod liver oil is used to supply the vitamin D, but the merits of cod liver oil are its content of vitamins A and D which can be derived from green food and through the agency of light, so that cod liver oil is not necessary for profitable pig production. Incidentally the value of the practice of turning young pigs out on to pasture for a portion of the day in favourable weather is hereby explained. If, in the feeding of pigs, milk or milk substitute were omitted the supply of proteins and minerals in the diet would fall short of requirements, consequently the animals would not thrive. Hence the special importance of milk or meat or fish meal in the diet. In emphasising these four dietary essentials and their food sources sufficient has been said to show that the important matter in pig feeding is to ensure a full supply of each of those food factors, shortage of any one of which acts as limiting factor to progress. Nor is this all. The pig is, like ourselves, an animal which suffers from cold, and while it will grow and fatten under cold conditions the results are slow and unsatisfactory : profits are enhanced by providing quarters in which the animal is sufficiently warm to sleep in comfort and to give the maximum return for the food consumed.

The group of home-produced foodstuffs which constitutes such an eminently satisfactory diet for the pig, is, in practice, giving excellent results with poultry also, where, again, the more important feature of correct feeding

is the provision of an adequate supply of each essential nutritive factor. To both chickens and laying fowl the all-important vitamin A must be provided in the form of fresh green food or grass meal or cod liver oil. Otherwise, no matter how many items in the dietary, the results will be most disappointing. Again, in the case of chickens being reared in the house, either direct light or cod liver oil is essential to prevent leg weakness and soft bone. Laying fowl on range, or having access to a pen, obviously receive an adequate supply of the vital light. As in the case of pigs, the necessity for cod liver oil is for poultry obviated by a supply of green food and light. Still, the requirements of the birds in respect of these vitamin factors have not altered from the days when cod liver oil was freely available, but we have alternative sources of the food factors in question. Separated milk or meat or fish meal form an appropriate fraction of the diet in order to provide the proteins and minerals so absolutely necessary for good vigorous growth and heavy egg production. Potatoes, oats and barley, with the other items mentioned, make up a complete diet for all kinds of fowl.

Though it is well known that cooked potatoes are excellent for both pigs and poultry, and that four hundredweights of them provide the same amount of nutriment as one hundredweight of grain or good quality meal, too few potatoes are fed or, should I say, grown for feeding to stock. In most cases some are fed, with, as farmers are well aware, the most satisfactory results. The very considerable extent to which potatoes may be given to pigs and poultry may not, however, be realised. Some 40 per cent. of the diet of laying hens may be supplied as potatoes without diminishing egg production. Twenty laying fowl will consume about 100 ounces of grain and meal per day. Now if the grain and meal are limited to 60 ounces and the remaining 40 ounces replaced by 160 ounces of potatoes egg production remains the same provided of course, the other essential items of the diet are included. Growing chickens are voracious consumers of meal, but recent experiments demonstrate clearly that their meal ration may, without hindering progress, be limited to 2½ ounces per day throughout the growing period if potatoes are freely supplied. A group of a dozen eleven weeks' old chickens consuming 48 ounces of meal per day makes no more progress than a similar group getting only 30 ounces of meal with the remaining 18 ounces replaced by 72 ounces of potatoes. A six months old pig will consume per day about 6 pounds of meal of which some 3½ pounds may, without reducing the rate of gain of the animal, be replaced by potatoes. Thus, in the production of a fat pig, almost three-quarters of the meal which would be required in an all-meal ration may be satisfactorily replaced by potatoes. Obviously there is great scope for the feeding of potatoes to live stock. Four tons of them provide the same amount of nutriment as one ton, *i.e.*, the produce of one acre, of grain, but the comparable per acre produce of potatoes is at least eight tons.

I am often asked the best way to balance the diet of cattle—calves, dairy cows and young fattening animals. Here, as in the case of pigs and poultry,

balancing the diet really means making sure that an animal which receives a sufficiency of total food takes in adequate quantities of the proteins, minerals, etc., which are each essential for good results and therefore for profit-making. Really the best way to ensure that the diet of cattle is made satisfactory is to improve the pastures, to make better quality hay, and to ensile some green food for feeding in winter. If the preserved fodder which comprises such a large proportion of the food of cattle in winter is of good quality the balancing of the ration is an easy matter: on the other hand, if the hay is of poor quality and no silage or green forage is available there is far greater necessity to ensure an adequate supply of proteins and minerals in the remainder of the daily diet. By good quality hay I mean material which is cut early, made up into cocks with the minimum of delay, and ricked as early as it can be without incurring the risk of heating. A ton of this type of material is as useful to a dairy cow, a calf or a fattening animal as two tons of the drab coloured weathered material which so often passes under the name of hay in this country. No matter how good hay is, however, every farmer knows that grass on the date of cutting for hay is inferior in feeding value to what it had been three weeks previous thereto. If you want real good substantial winter feeding, cut the green herbage at this earlier stage but because this luscious herbage cannot be easily dried into hay it must be ensiled. Ensiled young grass is the premier winter food for cattle, but unfortunately, the process of ensiling is taking on very slowly in this country. Beans in many places, and flax seed in a few districts, are grown for the purpose of mixing with oats for cattle feeding. Both are excellent for the purpose. Meat meal is similarly useful to balance the ration for calves, cows and fattening animals to all of which however, it must be introduced very gradually as it is distasteful to cattle to begin with, though consumed with relish once they become accustomed to it.

SEED WHEAT SUPPLIES 1943-44.

Broadcast Talk given by T. O'Connell, F.R.C.Sc.I., M.Sc., Agricultural Director, Department of Agriculture, on 2nd November, 1943.

During a recent debate in Dáil Éireann a feeling became evident that much of the produce of last season's wheat crop is unsuitable for seed purposes and, accordingly, that supplies of seed may be unprocurable in some districts. Lest this feeling may generally prevail and lest it may discourage the sowing of wheat to any extent whatever, the Minister for Agriculture wishes the position to be explained so far as the Department has been able to ascertain it.

First, as to the quality of last season's grain. Farmers need no reminder of their trying experiences during the past unfavourable harvest. They will, however, admit that of the three main cereal crops, wheat suffered least damage and, notwithstanding weather conditions, many wheat crops were harvested in reasonably good condition. The appearance of the grain may not be attractive but the germination in many cases is much better than might have been expected. Evidence of this is afforded by the quality of the samples reaching the Department's Seed Testing Station from seedsmen and from farmers during the past month. The seedsmen's samples have naturally been hand-picked, but allowing for this, the quality has not compared unfavourably with that of previous years. Average germination has been in the neighbourhood of 92 per cent. but many excellent looking samples have tested as high as 95 per cent. to 98 per cent. These latter figures apply, however, mainly to samples which have been artificially dried. Farmers' samples have ranged round 90 per cent. and on the whole, few samples of very low germination have been received. A noticeable feature of these low germinating samples was the presence of sprouted grains.

While the average germination of the samples received at the Station is below that of normal seasons, it is evident that a fair proportion of the past season's crop is of reasonably good quality. The problem is to reserve sufficient grain of this quality as seed and having reserved it, to ensure that germination will be maintained up to sowing time. In the solution of this problem, co-operation will be required from growers, seed assemblers, flour millers and seed retailers throughout the country.

Notwithstanding the relatively lower quality of this season's grain it may be assumed that many farmers will retain their own seed, or possibly procure seed by purchase or exchange from neighbouring farmers. The proportion

retained will perhaps be less than in a normal season, but it is probable that up to 250,000 barrels of seed wheat will be provided in this way. Obviously the care and treatment of this seed is the first consideration.

It is not proposed on this occasion to deal at any length with the storage and treatment of seed wheat. This is dealt with in the Department's Special Leaflet No. 23, published about a year ago. In the meantime, results of preliminary storage trials conducted at the Department's farms have become available. They indicate clearly that apart from artificial drying under proper conditions the old-fashioned practical method of storing seed wheat in the stack is second to none. Farmers do not always find it convenient to keep wheat in stack and in most cases threshing must take place long before the seed is required for sowing. At all times there is a risk that seed wheat stored under farm conditions may deteriorate in germination. There is little doubt that most of the thin brairds and partial failures of wheat crops are due to this cause rather than to poor germination originally. This risk is infinitely greater in a season like the present with grain of high moisture content. Dead grain cannot produce a braird, and its use as seed means a loss of good food. To the farmer it means the loss of a valuable crop, but this he can avoid by having his seed tested for germination.

Apart from the facilities provided at the Department's Seed Testing Station, farmers' samples may now be tested for germination at 94 Vocational Schools throughout the country. Information in this connection may be obtained from the Headmasters of the schools, from the Chief Executive Officers of the County Vocational Education Committees and from the Agricultural Instructors. Farmers are strongly advised to take advantage of these local facilities and thus avoid the congestion and delay which otherwise will inevitably occur at the Department's Seed Testing Station.

Many farmers throughout the country make a practice of selling seed wheat to their neighbours. This is a useful service when the seed is the produce of a good foundation stock and where the germination is satisfactory. Unless such seed is the produce of a crop recently threshed, it may, as in the case of the farmer's own seed, have deteriorated in germination with equally unfortunate results. The seller is legally bound to quote the percentage of germination, and if there is any doubt whatever, the seed should be tested shortly before sowing.

Let us next consider the large volume of seed wheat which is handled by the Seed trade. If we assume an area of around 700,000 acres in the coming season and assume further that an area of 250,000 to 300,000 acres will be sown with seed retained by farmers or purchased from their neighbours, a quantity approximating to 350,000 barrels of seed would require to be provided elsewhere. Permits have already been issued for the assembly of a quantity exceeding estimated requirements. Assemblers in some districts

are not experiencing much difficulty in procuring their quotas of seed of the prescribed standard. In other districts Queen Wilhelmina appears to have fared badly during harvest and first-class samples of this variety are scarce. Less difficulty is being met with as regards the variety Pajbjerg and apparently little, if any, as regards spring varieties such as Atle, which latter variety was least affected by unfavourable harvest conditions.

It has transpired that the higher standard of germination prescribed this season has caused assemblers to reject samples which would have been acceptable last season. The Minister for Agriculture has, accordingly, decided to revert to last year's standard of a minimum of 85 per cent. germination and the Emergency Powers (Cereals) Order, 1943, will be amended accordingly. It is anticipated that this concession will give assemblers a considerably wider choice in the selection of samples and enable them to fill their quotas more readily. This does not mean that seed of 90 per cent. to 95 per cent. and upwards will not be on offer, and purchasers will naturally give preference to the best. Consignments of wheat quite suitable for seed purposes frequently reach the flour mills.

The Irish Flour Millers' Association has been requested to co-operate with the seed trade in drawing attention to such lots of winter and spring varieties respectively. As an extra precaution the Association has been requested to hold a reserve of sound grain against any possible seed emergency. One firm of flour millers, in the Midlands, acting in co-operation with the Agricultural Instructors, has, in fact, already most commendably assembled and dried up to 30,000 barrels of named varieties in first-class condition.

Taking everything into consideration, no general shortage is feared, although some winter varieties, such as Squarehead Master and, to a lesser extent, Queen Wilhelmina, may not be so plentiful as spring varieties, such as Atle.

Assemblers of seed wheat operate chiefly in the wheat-growing areas. Outside these areas farmers usually obtain their supplies from retailers who, in turn, purchase from the wholesale assemblers. These retailers are an essential part of the machinery of distribution, particularly in remote districts where the requirements of individual growers are frequently in terms of stones rather than of barrels or tons.

It has been represented to the Minister for Agriculture that the present margin of 1s. 6d. per barrel, which includes cartage from railway station, does not offer sufficient inducement to retailers who usually order in lots of less than 6 tons, and who are called on to sell in small quantities. The Minister realises the necessity of having supplies of seed wheat available in all districts and has, therefore, decided to increase this margin to 2s. 6d. when quantities not less than one barrel are sold, and by an extra penny

per stone when the quantity is less than one barrel. The scarcity of seed wheat which occurs in some districts is sometimes due partly to the farmers in these areas and partly to the retailers. The one will not place his order until the last minute, the other will not order from the wholesaler lest the wheat may be left on his hands. The remedy is obvious but the Minister trusts that retailers will take some risk and not be without a few barrels of seed wheat at any time during the next four or five months.

Complaints are sometimes made that seed wheat of guaranteed germination has failed to grow. This is frequently due to delay in sowing and to loss of germination while the seed is kept under unsuitable conditions. The Department's scheme for the assembly of artificially dried seed of spring varieties will again be in operation this season. Many of the larger assemblers have also undertaken to offer artificially-dried seed of winter varieties.

No wheat can be expected to retain germinating energy if stored in a damp cold loft or store, but artificially-dried wheat will not deteriorate if given any reasonable chance. Dried seed should, therefore, get preference. It is well worth the extra price.

As in previous seasons home-grown seed, particularly of spring varieties, will contain a slight admixture mainly due to adulteration during threshing operations. This admixture in wheat grown primarily for milling purposes will not affect either the yield or the value of the crop.

A long-felt want in connection with the further propagation of pedigree seed wheat on a commercial scale has recently been filled by the establishment of a new Irish company. It is anticipated that this Company will, in the near future, make available pure stocks of a number of varieties which have already been proved suitable to our conditions.

SUMMARY.

No shortage of seed wheat of reasonably good quality is anticipated.

Farmers who intend to use their own grain for seed are urged to have it tested for germination previous to sowing.

Those who purchase seed either from other growers or from seedsmen are entitled to a statement regarding germination. Intending purchasers of seed wheat should place their orders in advance and so give retailers an opportunity of ordering in bulk. The Minister for Agriculture urges all licensed assemblers of seed wheat to lose no opportunity of acquiring grain up to seed standard.

The Minister also urges all retailers of seed wheat to stock some supplies even in the absence of definite orders to cover those stocks. Retailers who experience difficulty in procuring stocks should communicate with the Cereal Section, Department of Agriculture, St. Stephen's Green, Dublin.

CORRECTION.

Page 35, paragraph 1, line 12, "4 ozs." should read "10 ozs."

POTATOES IN THE DIET OF LAYING HENS.

By

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In this country it is usual to include a large proportion of cooked potatoes in the diet of fowl. There is little information, however, as to the maximum amount which may be fed consistent with a high level of egg-production. Such information is of particular importance when poultry foods are scarce, since it is well known that a given area of land will produce at least twice as much food material in the form of potatoes as in the form of cereals. The literature on the subject reports several investigations in which varying proportions of the usual mash-grain fowl ration were replaced by potatoes, but few of the experiments were expressly designed to ascertain the maximum amount of replacement permissible. The greatest amount of potatoes fed would appear to have been in the feeding-trials conducted by Halman and Fermor (1) where heavy breed pullets consumed 4 ozs. per head per day of steamed potatoes.

Experiment 1 (1941/42).

Seventy-four March-hatched White Wyandotte pullets were selected early in October and divided into two groups of 37 each. They were accommodated in similar houses and had access to grass runs. Group I were given dry mash and grain; in Group II portion of the dry mash was replaced by potatoes. The mash allowance was weighed and placed in hoppers each morning, and the grain (whole oats) was fed just before dusk. The cooked potatoes for Group II were given twice daily—in the early morning and again at 1 p.m. The mash used was composed of cereals, cereal offals, meat meal, and salt, and contained 16 per cent. crude protein and 8 per cent. crude fibre. During October, trials were made in order to determine the greatest amount of mash which Group I would consume, and the highest proportion which could be replaced by potatoes in the proportion of one part of meal to four of potatoes and still leave the total ration within the appetite of Group II. The grain allowance was maintained at 2 oz. per head per day. By the 1st November the following rations were being readily consumed per bird daily.

	Group I	Group II
Meals	$2\frac{3}{4}$ ozs.	1 oz.
Grain	2 ,,	2 ozs.
Potatoes (raw weight)	—	7 ,,

Percentage of the meal-grain ration of group I replaced by potatoes in group II = 37 per cent.

Oyster shell was provided *ad lib.* Trap nests were in use in each house, and a record was kept of the individual egg-production during the six months November to April.

RESULTS FROM EXPERIMENT 1.

The health of the birds in both groups remained excellent throughout the experimental period. There were only two deaths in Group I and one in Group II during the six months. Two of these pullets died as a result of burst oviduct and the third from heart failure. As the deaths were so few and did not appear to have any relation to the feeding, the records of these three birds were not included in the final results. The average weight of the birds in each group at the start was 4¼ lb. and during the period of the experiment the average increase in weight in Group I was 1.9 ozs. and in Group II 1.8 ozs. The following Table shows the average egg yield per bird in each group for each calendar month.

	Nov.	Dec.	Jan.	Feb.	March	April	Total
Group I ..	9.6	6.3	11.6	18.1	16.8	15.4	78
Group II (potato group)	9.5	8.7	13.6	20.9	16.3	15.4	84

The total number of eggs laid in Group II was somewhat greater than in Group I. There was great variation, however, in the egg yields of the individual birds in each group and the difference is not significant.

EXPERIMENT 2 (1942/43).

The second feeding trial was conducted on similar lines to that of the previous year. Eighty-four February-hatched White Wyandotte pullets were divided into two equal groups. In this experiment portion of the grain as well as of the mash allowance of Group I was replaced by potatoes in Group II. The substitution was made on the basis of a ratio of mash or grain (oats) to potatoes of 1.2 to 4.0. On this occasion compensation was made for the loss of protein to Group II involved in the substitution and an appropriate amount of meat meal was added to the ration of Group II. Oyster shell was fed *ad lib.* and the birds had access to grass runs. The mash used was similar to that of experiment I. The following Table shows the amounts of the various items consumed per bird daily.

	Group I	Group II
Meals	2½ ozs.	1½ ozs.
Grain	3 „	1½ „
Potatoes (raw weight)	—	7½ „
Meat Meal	—	¼ „

Percentage of the meal-grain ration of group 1 replaced by potatoes in group II= 41 per cent.

Results from Experiment 2.

The health of the fowl was again excellent and there were no deaths during the experimental period. The average weight of the birds was 4 lb. 5 ozs. on the 1st November and during the six months of the experiment Group I added on the average, 13 ozs. and Group II, 11 ozs. The average egg-yield per bird in each group for each calendar month was as follows :—

	Nov.	Dec.	Jan.	Feb.	Mar.	April	Total
Group I ..	11.7	13.1	14.8	16.4	20.2	18.7	95
Group II (potato group)	11.4	11.8	13.7	17.0	20.7	19.7	94

The figures show that the trend of production was similar in both groups in each month, and that there was practically no difference in the total number of eggs laid over the six-month period. There was again considerable variation in the egg-yields within each group, but the high levels of winter egg production obtained indicate that potatoes may safely replace 41 per cent. of the mash and grain in the ration of laying pullets.

SUMMARY AND CONCLUSIONS.

Two feeding trials on laying pullets have been conducted over the six months, November to April, with the object of ascertaining the highest proportion of the usual mash-grain fowl ration which can be replaced by cooked potatoes.

In each experiment it was possible to replace approximately two-fifths of the total ration by potatoes. In experiment 1 mash only was replaced, at a ratio of 1 part to 4 of potatoes. In experiment 2 both mash and grain were replaced at a ratio of 1.2 to 4. The consumption of potatoes amounted to 7 ozs. per bird per day in experiment 1 and 7½ ozs. in experiment 2.

The health of the birds remained excellent in all groups throughout the experiments and there was no evidence of reduction in egg-yield as a result of the feeding of such a large proportion of potatoes. In experiment 1 the average number of eggs per bird over the six months amounted to 78 in the meal-grain group and 84 in that which received potatoes. In experiment 2 yields of 94 and of 95 eggs were obtained from the meal-grain and potato groups respectively.

References.

1. Halman and Fermor: Surplus Potatoes in Poultry Feeding. Jour. Min. of Agri Eng., Vol. XLIX, No. 3, p. 175.

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WHEAT GROWING.

Broadcast Talk given by PROFESSOR M. CAFFREY, B.Sc., A.R.C.Sc.I., Department of Plant Breeding, University College, Dublin, on Saturday, 20th November, 1943.

In his broadcast to farmers on the 15th October, the Minister for Agriculture announced the terms of a new Tillage Order which makes it compulsory on every farmer to devote a certain proportion of his arable land to the production of wheat during the coming year. This Order marks a new departure in Government policy in regard to wheat-growing, but nobody will deny that it is needed in the present circumstances to meet a serious situation. Although the Order is drastic, as the Minister admits, it is not impossible to fulfil, nor indeed, does it impose an unreasonable burden on our farmers. All the available evidence, both of the history of wheat-growing in Ireland, and of our own abundant experience in recent years, goes to show that wheat can be grown in all parts of the country, provided that its cultivation is carried out with due care.

It is hoped that, partly as a result of this Order, 700,000 statute acres will be sown to wheat before the end of next April. This area, if achieved, will be the largest ever sown under wheat in Ireland, but it is not the only target. What is really aimed at, is that half-a-million tons of millable wheat will be available at the end of the harvest of 1944. It is clear, therefore, that farmers have a double duty: to comply with the Order, and to ensure that the highest possible yield of grain is obtained from their wheat crops.

To provide that the Order may be fully implemented, it is essential in the first place to have on hand—either with seedsmen or with farmers who have retained their own seed—a quantity estimated at 500,000 barrels of reliable seed of the most prolific and best adapted varieties. Farmers who have listened to, or read, the broadcast of the Agricultural Director, Department of Agriculture, will know that this seed is likely to be available. It is very satisfactory to know too, that there are large stocks of valuable spring wheats, notably Atle. In this latter regard the present position is better than it has been for many years.

TREAT AS A ROTATION CROP.

To secure the best results in respect of grain yield, wheat must be treated as a rotation crop. It is unwise to grow it continuously, year after year, on the same land. It prefers a deep, rich soil, and yields well after mangels,

swedes, sugar beet, potatoes, peas and beans. In the present circumstances farmers should, in their own as well as in the national interest, follow these crops exclusively with wheat. Wheat can also be grown successfully after lea, particularly short-term lea. Temporary leas can very easily be prepared for winter wheat sowing, even in unfavourable weather conditions, owing to the good physical condition of the soil. It may be that, in those areas where the Tillage Order requires that ten per cent. of the arable land must be sown with wheat, these recommendations will not provide a sufficient acreage for this crop; in that event the wheat might also be sown after oats, barley, or indeed, after another wheat crop, but in that case, a spring-sown variety is recommended.

SOW WINTER WHEAT.

The Minister recommends that farmers who have land "suitable for winter wheat" should prepare their land at once and sow as soon as possible. All land which does not become waterlogged in winter and early spring, and which is not very acid, in nature, is suited for winter wheat. There are many reasons, in addition to those advanced by the Minister, why farmers should sow this crop in autumn or early winter. Winter wheat is hardy, it yields more, stands better, is less susceptible to damage from fungus diseases and ripens earlier than spring wheat. Moreover, a substantial portion of the crop sown in winter will ease the pressure of work in the spring and will also ensure an earlier start with the harvest.

USE THE BEST VARIETIES.

The highest possible yield of grain and straw can only be obtained by the selection of the variety best adapted to the soil and climatic conditions under which it is grown. I will now give brief notes on those varieties which I consider most suitable for cultivation in this country. I shall deal with winter varieties first :—

(a) WINTER VARIETIES :—

Pajbjerg is the most reliable and the most prolific variety for cultivation on rich soils. It is exceptionally winter hardy. It stands well and gives an attractive sample of grain. It is oftentimes seriously attacked by yellow rust. It ripens rather slowly and farmers are warned that it should not be sown later than the middle of February.

Queen Wilhelmina (Double White Stand-up). This is the best variety for medium soils. It is well adapted to our climate, having been successfully propagated here for over 40 years. The ear is dense. The grain, which is white, is of good size, plump and of high bushel weight. It is susceptible to attacks of yellow rust. Queen Wilhelmina can be sown with safety, in all parts of the country, up to the end of the third week in February.

Squarehead's Master is the best variety for cultivation on poor and light land, and has always done well in the western areas of the country. The straw is long, and is susceptible to 'lodging' on rich soils. The grain is red, large, plump and of good bushel weight. It can be sown up to the end of February.

(*b*) Spring Varieties :—

Atle. This variety, which was bred in Sweden, is superior to all other varieties of spring wheat for cultivation on rich, fertile soils. It yields well and the grain in a well-grown sample is square, plump, translucent and of high bushel weight. In badly-grown crops the grain is on the small side. It is susceptible to yellow rust. Atle should be sown during the month of March.

Red Marvel. This variety does well in soils of average fertility. It used to be difficult to get reliable seed, but the Department of Agriculture have taken steps to ensure the propagation of pedigree stocks of this variety. It will pay farmers to get seed of this variety from a reliable seedsman who will be prepared to give a guarantee as to its genuineness. Red Marvel should be sown during the month of March.

April Red. There is no variety of spring wheat as well suited for growing on poor or average soils as April Red. It has excellent qualities, it grows rapidly, is resistant to disease, ripens early and produces a grain which I am informed is of high quality for milling purposes. Its only drawback is the weakness of its straw which, in practice, prevents its cultivation on rich soils. It can be sown during the months of March and April.

Diamant (Diamant 2). This variety is of Swedish origin. It produces a fine sample of deep, red, translucent grain which I believe is not of as high milling quality as its appearance would indicate. It is very susceptible to yellow rust and in the eastern part of Ireland it is infected with this disease to such an extent that the yield and the quality of the grain is well below the average. It has, however, done well in the west of Ireland, and its cultivation is recommended there on soils of average fertility. It can be sown with safety up to the end of April.

Fylgia and Kolben. These two varieties which are of Swedish origin produce grain of excellent quality for milling and baking purposes. They could be used to replace April Red on light land if the supply of this variety is insufficient to meet the demand.

From what has just been said it will be clear that one of the main objectives of our wheat-breeding programme is the production of varieties—both winter and spring—resistant to attacks of yellow rust. While none of the varieties of bread wheat which we have produced appear to be immune to the attacks

of this disease under all conditions, we are fortunate in having secured many which are very highly resistant, and these are now being propagated with a view to their eventual distribution to farmers throughout the country, should they prove adapted for growing on Irish soils. The most prolific of these varieties has been derived from a crossing between Ironmaster and Pajbjerg and in the small-scale trials carried on, on the Albert College Farm, Glasnevin, it has outyielded Pajbjerg, and other commercial varieties by from ten to twenty-five per cent.

We have also new forms derived from crosses between Atle and April Red and Ironmaster which, apparently, combine the good qualities of Atle with resistance to yellow rust. These are spring types, and arrangements have been made to have them propagated intensively.

TEST FOR GERMINATION.

Before sowing, the germination of the seed should always be determined. The appearance and condition of the sample does not provide a reliable indication of its germination capacity, oftentimes samples of apparently superior quality and condition have proved disappointing when their germination has been determined. Arrangements have been made under which the Rural Science Teachers in Vocational Schools will test, free of charge, farmers' samples of seeds submitted to them, and farmers who live in the vicinity of these schools should make full use of this valuable service. This would ease the pressure on the Department's Seed Testing Station which can only with difficulty cope with the numerous samples submitted to it.

DRESS THE SEED BEFORE SOWING.

Seed Dressing. Wheat seed should be dressed with a powder disinfectant at the rate of half-a-pound per barrel of wheat. An efficient dressing will control bunt and all other fungoid pests that adhere to the external portions of the grain. During the last few years farmers in some areas have been remiss—possibly owing to the difficulty of getting seed disinfectant powders —in regard to the dressing of their seed grain and there have been reports of extensive bunt infections during last harvest. It would appear that there will be on the market during the present season large quantities of efficient organo-mercuric seed dressings. These are recommended. Failing these, farmers may use copper carbonate for their wheat seed, but they should remember that this particular dressing is not regarded as satisfactory for the treatment of oats and barley.

In order to prevent the depradations of crows and rodents, farmers in many parts of the country have adopted the practice of dressing their wheat seed with tar previous to sowing. There are, however, three points to be borne in mind in connection with this dressing: first, heavy dressings of tar

will cause serious injury to the wheat seed, it is undesirable to use more than one pint of tar per barrel of wheat seed ; second, the application of lime as a drying agent will reduce the possibility of injury to the treated seeds and, third, tar has of itself, little germicidal value.

FUNGOID DISEASES.

There are many fungoid diseases and pests attacking wheat which cannot be controlled by seed dressings, and from time to time some of these—which may have done some local damage—have caused widespread alarm and rendered ill-service to the Government's wheat campaign. A few years ago there was a serious attack of black stem rust, later on wheat midge was prevalent, particularly in parts of Louth and more recently, we have had *Gibberella Saubinetti* which was common last year. It is rather providential that the pests which we cannot control by dressing or otherwise are themselves rather susceptible to weather conditions, they have their occasional suitable seasons alternated by long periods of relative insignificance. Three diseases stand out, however, as having the possibilities of ever-present menace to the wheat crop, *viz.*: root rots, bunt, and yellow rust. Root rots can, however, be kept in check by the means of a tillage rotation, bunt can easily be controlled by dressing the seed with a powder disinfectant, and in regard to yellow rust, we have now, as has been indicated, bred several varieties, both of winter and spring wheat, which are strongly resistant to this serious disease.

INSECT PESTS AFFECTING FOOD PRODUCTION.

Broadcast Talk given by J. CARROLL, D.Sc., University College, Dublin, on Thursday, 27th January, 1944.

Seeing that the major effort in connection with increased food production is being made on the farms I will speak to-night about the more important insects which may be encountered as pests of farm crops. In times such as these, when much old pasture land is being broken up, wireworms will frequently appear.

Wireworms may be expected to occur in any field which has been under grass but they do not occur with the same degree of abundance in every grass field. In some fields they may be very scarce. In some they may occur in bigger numbers and they may be very abundant in others. Wireworms will remain in the soil for four or five years after grass fields have been ploughed up but they will be decreasing in numbers during this period. When old grass land is being ploughed it is advisable to plough deeply and turn the sod well down. If this is done and if the sod is left underneath as much as possible during subsequent cultivation, the majority of the wireworms will be content to continue feeding on the old sod during the first season after ploughing, and consequently, the crop which has been sown, *e.g.*, the cereal crop will escape attack to a great extent. Even though the first crop after lea has been escaping obvious wireworm attack it would be well to determine, by examination of the underlying sod here and there throughout the field, whether there are many wireworms in it or not. If only small numbers of wireworms are found it may be assumed that the field is fairly free from them and, therefore, the second and subsequent crops can be grown without much fear of extensive wireworm attack. If, on the other hand, the first crop after lea has been obviously damaged by wireworms, or if many wireworms are known to be feeding in the old sod then it may be taken for granted that they will constitute a great danger for the crop which is to be grown the following year.

The question of what the second crop should be is a matter of some importance because different crops are liable to be damaged to a different extent by wireworms. Cereals, particularly wheat and oats, and also potatoes are liable to be damaged severely when attacked. Root crops, even though attacked, will usually not suffer so heavily. Field beans and such fodder crops as kale, rape, vetches, etc., are fairly resistant and can usually do well even though

wireworms are plentiful. Flax is also markedly resistant to wireworm attack. When it is known, therefore, that wireworms are plentiful in any particular field, it would be unwise to plant in the second year either potatoes or a cereal crop. Roots or fodder crops should be planted in such fields and the cereals and potatoes put in the fields which have not so many wireworms. By the time the third crop is to be sown a great proportion of the wireworms will have changed into mature beetles and left the soil and, consequently, the danger of damage will have diminished considerably.

Whenever it is feared that a grain crop may be attacked by wireworms a somewhat heavier seeding than usual is desirable, and if there is evidence that a grain crop is actually being attacked a heavy rolling should prove useful. Unfortunately in these times we have not the Nitrate of Soda or Sulphate of Ammonia to apply as a stimulating top-dressing.

Leather-jacket grubs may also be present in considerable numbers in grass fields and, if so, are liable to cause extensive damage to the first cereal crop planted after breaking up lea. As the leather-jacket grub completes its development into a " Daddy-Long-Legs " fly in one year, these grubs will all leave the soil during the year after the breaking up of lea and, consequently, will not remain to attack the second crop. In the spring or early summer, leather-jacket grubs come to the surface of the ground during the night and cut the young plants of the cereal crop just at ground level. If these grubs are abundant they can cause serious damage and sometimes, indeed, the crop may be almost completely destroyed by them. It has been quite well established that the most effective way of controlling leather-jacket grubs is the scattering of a poison bait over the field where they are causing trouble. The bait is made by mixing one part by weight of Paris Green with twenty-five parts by weight of bran. This mixture, after being slightly moistened, should be scattered broadcast, in the evening, at the rate of about 25 to 30 lb. per acre, over the areas which are being attacked. During the night the grubs feed on the poisoned bait and are killed. The bait should be applied as soon as possible after the presence of the pest is detected. Great care should be taken with such a poison bait so that animals may not have access to it before it is scattered.

The only other insect pest of cereals which I will mention is the frit fly. This is a very tiny fly which lays its eggs in the spring, principally on young oat plants. The very small maggots which hatch from these eggs bore into the young plants, and plants so invaded are killed. The best way to guard against possible frit fly damage is by sowing oats as early as possible so that the plants may be fairly well grown and well established before the little frit fly maggots commence to hatch. If a crop is well established and growing vigorously before frit fly attack starts it has a very good chance of growing on fairly satisfactorily in spite of such attack. On the other hand, the late sown and backward crop may be very seriously damaged or almost completely

destroyed. This is particularly the case if the crop has not commenced to send out tillers.

In the case of root crops, the insect pest most likely to cause damage and loss is the turnip flea beetle or turnip fly. As is well known, these little jumping beetles attack swede, turnip and cabbage seedlings as they are coming through the soil. The attack may sometimes be so heavy as to completely destroy the seedlings and render a re-seeding necessary. If the seedlings have got into the rough leaf condition before the attack commences they are generally able to survive and grow on in spite of the attack. The best precaution, therefore, that can be taken to guard against possible turnip fly attack is to sow the seed early, not later than the first week of May. The seed bed should be well prepared and reduced to a fine tilth. Adequate manuring is most desirable and the drills should be rolled after sowing. The whole idea is to get quick germination of the seed and the seedlings forced into the rough leaf stage as early as possible so that they may be well established and growing vigorously before the "turnip fly" becomes abundant. If there is evidence that the turnip fly is commencing to attack while the seedlings are still in the very young stage a decided lessening of the attack may be brought about by dragging a greased sack over the drills, pulling the sack in such a way that only the end of it trails on the ground. Great numbers of little beetles will stick in the grease. These can be scraped off as often as necessary and destroyed and then, fresh grease should be smeared on the sack. The application of very fine dusts such as cement dust or shale dust can alleviate to some extent the intensity of turnip fly attack, if such dusts are applied just as the seedlings are coming through the soil and while they are damp. Dusting with a derris powder dust is the best control treatment, but derris powder is not, unfortunately, obtainable now.

In some years the mangel and beet fly may be particularly abundant and, therefore, likely to cause severe damage to the mangel and beet crop. This fly lays its eggs on the leaves of plants. The maggots which hatch out burrow into the leaves and by feeding between the two skins, cause conspicuous blotches in the leaves. Leaves badly damaged in this way are, of course, of little use to the plants. If an attack by this pest commences while the plants are still young and small they may be so badly damaged that further growth will be seriously retarded and the ultimate crop very much reduced. The attack will have most serious consequences if it occurs during a spell of very dry weather. If mangel and beet plants are well grown and have a good quantity of leaves before an attack of the fly commences it is only natural to expect that they cannot then be so seriously damaged and that they have a good chance of growing on fairly normally in spite of the attack. Again, therefore, with mangels and beet, as well as with turnips, one should aim at getting the seed sown as early as possible, and doing everything in one's power to stimulate rapid germination and quick growth. There is little else that one can do to forestall the possible damage which may be caused by an

attack of the mangel fly. One sometimes hears of spraying or treating the young plants with some strongly-smelling substance in the hope that such substance may keep the flies away from the crop. In reality, such a procedure gives the plants little protection except, perhaps, for a very short period of time.

The insects which I have mentioned are the ones which are most likely to be encountered to a serious extent on farm crops. Of course, many other miscellaneous ones may occasionally cause damage also, but I have not time this evening to deal with such others. It should be taken as a general principle, however, that if a crop is strong and healthy and well established and is growing vigorously when it is attacked by an insect pest then such a crop will have a very good chance of surviving the attack and, ultimately, producing a satisfactory yield in spite of the attack. No effort should be spared, therefore, in doing everything possible to stimulate the early and the rapid growth of crops—such is the best insurance within a farmer's power against most of the common insect pests. It is most desirable also that attention should, be paid to the suppression of weeds in the crops and around the fields, to the removal from the fields of crop remains, such as potato stalks, etc., and the elimination as far as possible, of all unnecessary rubbish dumps. By attending to these matters many insects will be deprived of convenient sheltering and breeding places and, consequently, the likelihood of these insects becoming abundant is considerably reduced.

I am sorry that I have not the time to-night to say something about the insect pests which may be encountered in small gardens, allotments and orchards. There are many such pests and much could be said about them. In this connection I wish to call your particular attention to the fact that two very informative leaflets dealing with such pests have been issued by the Department of Agriculture. These are Leaflets No. 85, entitled "Some Injurious Orchard Insects and Mites," and Leaflet No. 101, entitled "Diseases and Pests of Vegetable Crops." These leaflets may be obtained free of charge on application to the Department of Agriculture, Dublin. It is most desirable that everyone interested in vegetable and fruit production should possess and study them.

SPRING WHEATS.

Broadcast Talk given by JOHN J. BRADY, M.Agr.Sc., Inspector, Department of Agriculture, on 17th February, 1944.

The season for sowing winter wheat is drawing to a close. Less than two weeks now remain during which winter varieties may be sown. From now on the sowing of the variety, Pajbjerg, is not recommended, but varieties such as Queen Wilhelmina, Fenland Wonder and Juliana may be sown with safety up to the middle of next week. The varieties Yeoman II and Squarehead's Master can be sown up to the end of this month. In previous years, Queen Wilhelmina has been sown by many farmers as late as the end of February, and even in early March, with satisfactory results, but it should be borne in mind that late sowing of winter wheats naturally results in later ripening and in an unfavourable season there is the danger that such late-sown crops may not mature properly. Consequently, no effort should be spared to ensure that as much winter wheat as possible will be sown during the remainder of this month.

So far as can be judged, the acreage of wheat sown up to the present falls short of expectation. Even on the assumption that a large area will be sown with winter wheat during the next ten days it is certain that at least 400,000 acres will need to be sown with spring varieties if our bread requirements are to be assured for next year. This, in conjunction with the sowing of other spring crops, is a formidable task which will require the best efforts of every farmer.

While it is essential that a very large acreage of spring wheat should be grown in the coming season, it is equally important that farmers should leave nothing undone to ensure that the highest possible yield of grain will be obtained from their crops. High yields are of the utmost importance both to the farmer and the nation. The object of this talk is to give some advice which may be helpful towards securing maximum production from the coming season's spring wheat crop.

As in the case of winter wheat, the best results may be expected from spring varieties when they are sown after one of the manured crops, such as roots, potatoes or sugar beet. Experience has shown that excellent crops of spring wheat can also be grown on lea land. In so far as can be arranged, wheat should not be grown on land which grew wheat or barley in the previous year, particularly if the soil is alkaline, owing to the danger of attack by the

disease known as "Take-All." No doubt a large acreage of wheat must necessarily be sown after another cereal crop in the coming season, but the area should be limited as far as possible by giving wheat preference on manured ground and on lea.

Little need be said regarding cultivation, except to stress the importance of securing a good firm seed bed. This is an essential condition for the production of satisfactory crops of spring wheat, particularly when it is grown on lea. It will be very difficult to obtain the necessary degree of consolidation on lea unless the land has been ploughed with a well-turned furrow. However, care should be taken to secure it at all costs, otherwise the crop may prove a failure.

Seed assemblers throughout the country hold fairly large stocks of seed wheat of some spring varieties. These stocks together with such lots as have been reserved by farmers would be sufficient to meet requirements in normal circumstances. But sufficient winter wheat has not been sown up to the present and unless all available stocks of winter varieties are sown during the next ten days or so, local shortages of spring wheat seed may be experienced. Consequently, it is of the utmost importance that you should concentrate on the sowing of winter wheat before the season ends. Failure to do so may mean that the required acreage of wheat cannot be grown this year since sufficient seed of spring varieties may not be available. While a big proportion of the seed held by assemblers has been kiln dried and may be expected to have a high germinating capacity, the considerable stocks reserved by farmers have had no such treatment and, in consequence, the germination of these stocks may not be so satisfactory. Experiments carried out at the Department's Agricultural Schools during the past few years have demonstrated that the germination of wheat can be maintained at a high level by keeping it in the stack until the approach of seeding time. These experiments also showed that the germination of wheat which is threshed in autumn or early winter is liable to deteriorate to a remarkable extent during storage under ordinary farm conditions. While some farmers have their seed wheat in the stack yet, the majority probably threshed early in the winter, and in such cases there is the danger that the germination of the grain may have declined and perhaps will continue to fall until sowing time arrives. Consequently, every farmer should take the precaution of having his seed wheat tested for germination shortly before sowing. The sowing of "dead" seed is simply a waste of valuable food and will certainly result in a crop failure. In addition to the facilities provided at the Department's Seed Testing Station, your samples may now be tested for germination at almost any Vocational School and you are strongly advised to avail of these facilities.

Spring wheats do not tiller to the same extent as winter wheats and they require to be sown at a heavier rate, ranging from 25 to 29 stones per Irish

acre. The size of the seed should be taken into account when deciding on the rate to sow. Other things being equal, a variety with a large grain such as Red Marvel, should be sown at a heavier rate than a variety characterised by small grain, such as Atle.

All seed wheat should, if possible, be dressed before sowing with one of the mercurial powder preparations which are obtainable from seed merchants. These preparations will not only control bunt or covered smut, which can be a serious disease in wheat, but they will also ensure a vigorous healthy braird.

The choice of a suitable variety is one of the most important factors in the production of prolific crops. There are a number of excellent varieties of spring wheat available at present. From these you will have little difficulty in choosing a variety to suit your particular soil, but if you have any such difficulty you should obtain the advice of your local Agricultural Instructor.

In recent years the variety, Atle, has become very popular with farmers in the good wheat-growing areas. It is undoubtedly the best variety of spring wheat for cultivation on good, rich land. The straw is short and very resistant to lodging. It yields remarkably well on suitable land and produces red grain of good milling quality. There are fairly large stocks of Atle seed available. This variety may be sown with safety up to the end of the first week in April. Although Atle is an excellent variety, it is not the best one to grow in all cases. This variety has acquired such a good reputation that farmers who have not hitherto grown it and who have not suitable soil may be tempted to cultivate it on a large scale this year. Such farmers would be well advised to proceed cautiously before sowing Atle to the exclusion of a variety which they know to be reliable on their particular soils. If the soil and district are not suitable Atle may give a disappointing yield of poor quality grain. Most home-grown stocks of Atle now contain a slight admixture of other varieties. Steps have been taken to remedy this position and it is anticipated that pure stocks of Atle now in course of propagation will be available next year in limited quantity.

The variety, Red Marvel, which at one time was the most widely grown of all spring wheats has now been replaced to a large extent by Atle. It is, nevertheless, a useful variety for land which is not good enough for Atle. Red Marvel may be sown up to the end of March, but provided a good seed bed can be obtained, this variety usually gives a better return when sown before mid-March. For a number of years past, pedigree stocks of Red Marvel have been propagated by the Department of Agriculture and, as a result, the commercial stocks of this variety available at present are, in general, superior to commercial stocks of other spring varieties in respect of trueness to type.

Kolben is another spring variety which is suitable for cultivation on soils of average fertility. This variety usually yields fairly well. It produces grain of excellent quality and it can be sown with confidence up to the end of the first week in April.

The three varieties to which I have already referred, *viz.*, Atle, Red Marvel and Kolben, might be classified as early spring wheats. They require a fairly long growing period and, provided sowing conditions are favourable, the sooner these varieties are sown in the month of March the better will be the prospect of obtaining the maximum yield. These three varieties are beardless and are characterised by white chaff and red grain. Fortunately, there is another group of spring wheats comprising varieties which can be sown up to the end of April or even in early May, in some districts. The principal varieties in this group are Diamant, Fylgia and April Red. These three varieties have red chaff, red grain and, with the exception of April Red, they are beardless.

Diamant is a variety of Swedish origin which is best suited for cultivation on the lighter types of soil. In many cases, Diamant did not yield so well last season but since its introduction into this country several years ago, it has given good returns, particularly in western districts. The chief defect of this variety is its susceptibility to the disease known as Yellow Rust. This disease is not, however, very prevalent in the western parts of the country where Diamant is most widely grown.

The variety, Fylgia, has shorter and stronger straw than Diamant, and it can be grown on rich soils. It produces grain of excellent quality but, in general, its yielding capacity is only moderate. Under favourable circumstances, Fylgia gives a satisfactory yield, and some growers give preference to this variety.

April Red is the most important of the late spring varieties. No variety exceeds April Red in vigour and rapidity of growth. It is resistant to yellow rust and yields well in several parts of the country. It is specially suited for cultivation on all soils of poor to average fertility and will usually prove the most reliable variety for late districts. The chief defect in April Red is the weakness of the straw which renders it liable to lodging if grown on rich land.

The limitations which soil and climatic conditions tend to impose on the cultivation of winter wheat do not apply in the case of spring wheat. This crop can be grown on almost as wide a range of soils as the oat crop. Most farmers are, therefore, in a position to grow spring wheat. However much you grow will be required and it is hoped that by your efforts during the coming spring you will safeguard the nation against a bread shortage next year.

PIG FEEDING EXPERIMENTS AT THE DEPARTMENT'S FARMS.

Trials were conducted at the Department's farms in 1942 and 1943 with a view to determining the results obtainable from feeding a high proportion of potatoes to pigs when the meal used consists entirely of ground oats, separated milk being fed in limited quantity.

The pigs selected were between eleven and fourteen weeks old at the start of the trials. They were divided at each centre into two equal and comparable groups and the rations fed were as follows :—

GROUP I.

Ground oats	1 part by weight.
Cooked potatoes	8 parts ..

GROUP II.

Ground oats	1 part by weight.
Cooked potatoes	4 parts ,,

Both groups were given separated milk at the same rate—approximately 3 pints per pig per day—they were provided with equal amounts of green food and were supplied with sufficient drinking water throughout the trial. The potatoes were freshly cooked and were mixed with the ground oats immediately before feeding. The oats used were ground at the farms and contained about 13 per cent. of fibre. The rations were gradually introduced to the respective groups prior to the start of the trials during which the pigs were fed to appetite three times daily.

All the pigs except one, which was eliminated from Group I at Ballyhaise, remained healthy throughout the trials. The pigs in Group II remained cleaner in the skin and developed somewhat better conformation, thus presenting, as they approached bacon weight, a more finished appearance than those in Group I.

The results obtained are set out in the following Table :—

Centre	Group	No. of Pigs	Mean weight at beginning of Trial	Mean live weight at end of Trial	Average live weight increase per pig daily	Meal equivalent consumed per lb. live weight increase	Dead weight as percentage of live weight	Duration of Trial
			lb.	lb.	lb.	lb.	%	days
Athenry, 1942 ...	I	8	80	183	0.88	5.8	75.5	118
	II	8	80.5	205	1.05	4.7	75.5	
Clonakilty, 1942 ...	I	8	94.5	199.5	1.5	4.2	81.2	70
	II	8	93	211	1.7	4.2	81.4	
Clonakilty, 1943 ...	I	6	83	231	1.4	4 8	79 8	105
	II	6	81.5	249.5	1.6	4.7	78.9	
Ballyhaise, 1943 ..	I	6	78	205	1.0	5.0	74 6	126
	II	7	76	254	1 4	3 6	75 6	
SUMMARY of Results from 4 centres	I	28	84	203	1.15	5 0	78.0	—
	II	29	83	228	1 30	4.3	78.0	

Reports on carcase and bacon quality indicated a small difference in favour of Group II.

While both groups of pigs made fair progress, the results of these trials indicate that the feeding of a very high proportion of potatoes to fattening pigs when the meal used consists of ground oats only, is likely to reduce somewhat the rate of live weight increase and efficiency of utilisation of the ration as a whole.

STUDIES ON TOMATO NUTRITION—I.

The Effect of Varying Concentrations of Potassium on the Growth and Yields of Tomato Plants

BY

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Introduction.

During the past decade or two, workers in various countries have studied from many different aspects the role of the major elements in the growth and development of the tomato. Of these major elements potassium is perhaps the one used in greatest quantity in the production of the crop in these islands at all events, and consequently, much attention has been given to it from the scientific and practical aspects.

Studies have been made to determine the least amount of potassium required for satisfactory growth and development under a particular set of conditions but it will be observed that workers frequently concerned themselves with leaf and stem development primarily when deciding such minimum requirements. While much valuable information accrued from these experiments for the purpose for which they were carried out, the results, nevertheless, do not afford a complete picture. The fruit is an integral and very important part of the tomato plant and it is well known that the development to maturity of a crop imposes a very heavy drain on the available potassium within the plant, apart altogether from the fact that fruiting plants present a somewhat different appearance from non-fruiting under otherwise similar conditions. Also, it must be conceded that the main standard by which the grower will judge any treatment will be the yield of fruit obtained. The work being reported on in the present paper was undertaken to determine the effect of varying concentrations of potassium on the yields of tomato plants in order to ascertain the optimum dressings (basal and top) necessary for satisfactory growth and cropping. Throughout the work use was made, as far as possible, of the manures commonly employed by the commercial grower.

Experimental Procedure.

An experiment designed according to recognised principles and which was to a certain extent to act as a pilot for subsequent work, was set out in the 1941 season. The medium used for final potting both in the 1941 and 1942 experiment (which will be reported on more fully later) was peat of a fibrous nature and very acid reaction. This medium was chosen because it was

almost completely deficient in plant nutrients, especially potassium, and also because it constituted a good rooting medium, apart altogether from its excellent water holding capacity. The seed of the variety Potentate was sown on 25th March and the seedlings were pricked off into 4″ pots on the 15th April, using the Standard John Innes* seed and potting composts, respectively, which were steam sterilized. Up to the final potting, therefore, the seedlings were grown under conditions of ample potassium. The final transfer to 10″ pots supplied with drainage tins, took place on the 19th May, the plants being inserted complete with ball of soil attached. To ensure an adequate supply of nitrogen and phosphate, at this final potting 3 ozs. of hoof and horn meal (11 per cent. nitrogen) and 3 ozs. of superphosphate (16 per cent. phosphoric acid) were added to each bushel by bulk of the potting medium. In addition, ground limestone, 3 ozs. per bushel, was added as a source of calcium.

When deciding on the basal dressings of potassium cognisance was taken of the usual 1,000 lb. per acre dressing of potassium sulphate given before planting in commercial practice, which on the basis of a plant of 16,000 per acre would correspond to one ounce per plant, assuming an equal distribution of the nutrient. Accepting this as the standard, the upper limit was fixed at 1 oz. per plant, the dressings decreasing by quarter ozs. to nil. The upper limit for top dressing was fixed at ½ oz. per plant per application, *i.e.*, 500 lb. per acre of potassium sulphate on the above basis, and five different dressings were given, stepped down by eighths of an ounce to nil. The potassium treatments were, therefore :—

Base dressings	..	0	¼	½	¾	1 oz. per plant	
Top dressings	..	0	⅛	¼	⅜	½ oz. ,,	per application

The combination of these basal and top dressings involved twenty-five treatments in all. Five plants were used for each treatment. During the growing season six top dressings (of ⅛ oz., ¼ oz., etc.) were given at fortnightly intervals, commencing when some flowers of the second truss had set. In addition to the appropriate amount of potassium sulphate, ½ oz. each of dried blood and superphosphate was applied at every top dressing except the first, when sulphate of ammonia was used instead of dried blood. Dried blood was substituted for sulphate of ammonia because plasmolysis ensued after the application of the latter manure, the severity of the plasmolysis depending on the total quantity of salts added, the no-potassium plants being unaffected.

The plants were grown under cold-house conditions throughout, all routine treatments being carefully carried out. Eight trusses per plant were taken and at intervals during the season the drainage was returned to the pots.

* The John Innes potting compost supplies the principal nutrients in a balanced form and contains ample potassium for seedling growth. See "Seed and Potting Composts," by W. J. C. Lawrence and J. Newell. Allen and Unwin.

While the plants for the greater part made excellent recovery when the dried blood was given, the plasmolysis referred to caused some interference with the experiment. Nevertheless, certain interesting results were obtained which may be summarised as follows :--

1. The no-potassium plants made normal growth up to and subsequent to the opening of the flowers of the first truss but afterwards the rate of growth decreased. This is in agreement with the findings of other workers, notably White (12) and Janssen (3).

2. The no-potassium plants were conspicuous by their dark green foliage and sturdy growth up to the setting of the second truss, suggesting, perhaps, that very little potassium would be necessary up to this stage of development. Such a conclusion would be erroneous, for as will be seen later, beneficial results followed from relatively heavy dressings of this nutrient when given in the early stages.

This dark green colour of the foliage has been observed by others, notably Janssen (3) and Wall (7). Both these workers found that coincident with this stage of development of the no-potassium plants there was an accumulation of carbohydrate and nitrogenous material in the lower leaves. White (12) also records a similar accumulation of carbohydrate and suggests that the translocation of this is impaired in such plants.

3. Some three to four weeks after the final potting, potassium deficiency symptoms were apparent on most plants where this nutrient was omitted from the base dressing. The progressive development of these symptoms, which will be referred to later, was arrested by subsequent applications of potassium, but in the no-potassium plants the symptoms were progressive from the older lower leaves right up to the younger ones near the top. The growing points and the young leaves near to them remained free from deficiency symptoms in the no-potassium plants but the tops of such plants completely and suddenly collapsed towards the end of the season.

4. As might be expected, the yields from no-potassium plants were very significantly lower than from all potassium treatments.

5. At high levels of potassium, *i.e.*, where heavy basal and top dressings were given, the yields were depressed, the depression being proportional to the amount supplied. Conversely, at lower levels of potassium nutrition there was an increase in yield proportional to the amount given.

6. At the higher levels of potassium a chlorosis of the foliage, since reported on (11), occurred which had a deleterious effect on vigour and cropping.

7. The fruits of the high potassium plants were conspicuous by the degree of the intensity of greening around the top or calyx end as compared with that obtaining in the fruits at the lower levels of potassium. This led to uneven ripening as the calyx end was heavily tinged with green while the remainder of the fruit was red.

8. The fruits from the no-potassium plants were, on the whole, much smaller than from any of the potassium series. Their colour in the premature state was much paler, being almost white on the upper later-developed trusses while their final colour was orange red as against the deep red of the ripe fruits from most of the plants receiving potassium.

9. No additional response by way of increased yield was obtained from top dressings exceeding one-eighth of an ounce where a heavy basal dressing had been given.

1942 EXPERIMENT.

While the 1941 results were both interesting and encouraging, certain modifications were deemed necessary in the design of the experiment when the work was continued in 1942. The number of treatments and the number of plants per treatment was reduced so that it might be possible to repeat each treatment a number of times. On the experience of the 1941 experiment it was decided to retain only those treatments likely to give effective results, and consequently the 1942 dressings of potassium sulphate were as follows :—

Base dressings ..	0	$\frac{1}{2}$	1 oz. per plant.		
Top dressings ..	0	$\frac{1}{8}$	$\frac{1}{4}$ oz.	$\frac{1}{2}$ oz. per plant per application.	

The experiment, therefore, consisted of twelve treatments with three plants to each treatment. Each treatment was repeated three times so that the layout comprised three randomised blocks involving in all one hundred and eight plants. Buffer rows were placed at each end to obviate any advantage the end experimental rows might have through lack of competition. The plants were set out in rows of three on either side of a central path thirty inches wide, the rows being alternately eighteen and thirty inches and the plants eighteen inches apart in the rows. Seed of the same variety was sown the 24th March, the seedlings transplanted to four inch pots on 16th April and transferred to final (10″) pots on the 13th May. The subsequent treatment was similar to that adopted in the previous season in all other respects, except that dried blood was used from the start as a source of nitrogen for top-dressing to prevent a recurrence of plasmolysis.

It was decided to adopt the yield of ripe fruit as the principal standard by which the effect of these varying concentrations of potassium was to be judged.

A summary of the results for the duration of the experiment is given in Table 1. The fruit was picked at a stage of development comparable with that for commercial conditions. Since the yield of fruit is influenced by many factors, a study was made as far as was possible of the influence of variations in potassium on the more important of these. The following aspects therefore, were selected for special study :—

(1) rate of growth and development of plants ;
(2) flower production and set ;
(3) rate of ripening of fruit ;
(4) total yield ;
(5) size of fruit.

In the following pages, basal dressing will frequently be designed B and top-dressing T with the appropriate amount of potassium sulphate following thus, $B_{\frac{1}{2}}$; $T_{\frac{1}{4}}$; etc.

Growth and Development.

The growth in the early stages was again uniform though less rapid in all treatments than in the previous season. Up to the time of opening of the flowers of the second truss there were no very obvious differences between the no-potassium plants and those receiving dressings of this nutrient. Further, no apparent differences could be observed between the various potassium treatments. The dark green colour of the leaves of the no-potassium plants which was noticed during the early stages of growth the previous season, was not so noticeable in the corresponding series this season. The 1942 season was altogether less favourable to active growth and development than the 1941 season during the early stages of the experiment and consequently it is reasonable to suppose that the elaboration of nitrogen and carbohydrate material was retarded. Also, the peat sample used in the 1942 season contained some potassium recorded as low-medium, using Morgan's Method, which would enable the plants to make a type of growth somewhat approaching that in the potassium series. Both these conditions may have contributed to the absence of the dark green colour so noticeable in the 1941 season.

TABLE 1.

Summary of results from the various potassium treatments, 1942.

(Yields recorded in ounces).

Potassium Treat-ments	Ripe Fruit		Green Fruit		Total Fruits	Total Weight (oz.)	Percent-age fruit ripened	Weight of ripe fruit as a percentage of the maximum ripe fruit (B_1T_o =100)
	Number	Weight	Number	Weight				
B_oT_o ..	231	304	4	2	235	306	99	36
$B_oT_{\frac{1}{8}}$ ..	329	674	80	161	409	.835	80	79
$B_oT_{\frac{1}{4}}$ ..	368	669	88	158	456	827	81	78
$B_oT_{\frac{1}{2}}$ ..	347	651	97	189	444	840	77	76
$B_{\frac{1}{2}}T_o$ ..	365	696	19	25	384	721	96	82
$B_{\frac{1}{2}}T_{\frac{1}{8}}$ ..	370	769	86	173	456	942	82	90
$B_{\frac{1}{2}}T_{\frac{1}{4}}$ ..	387	791	82	158	469	949	83	93
$B_{\frac{1}{2}}T_{\frac{1}{2}}$ ..	364	683	107	200	471	883	77	80
B_1T_o ..	415	852	38	45	453	897	95	100
$B_1T_{\frac{1}{8}}$ ..	377	787	110	216	487	1,003	78	92
$B_1T_{\frac{1}{4}}$ ..	394	794	80	178	474	972	82	93
$B_1T_{\frac{1}{2}}$ ..	363	685	96	157	459	842	81	80
Sig. Diff.	88	171						

During and subsequent to the setting of the second truss however, there was a decline in the vigour of the no-potassium plants which became more accentuated as the season advanced. This falling off in vigour manifested itself by a reduction in the size of leaves, thinner, weaker stems, poor setting of the flowers and as shown in Table 2, by reduced stature of plant.

TABLE 2.

Relative heights of plants at the end of the sixth and fourteenth week after the Final Potting.

(B_oT_o=100 at the end of the sixth week).

	B_oT_o	$B_oT_{\frac{1}{8}}$	$B_oT_{\frac{1}{4}}$	$B_oT_{\frac{1}{2}}$	$B_{\frac{1}{2}}T_o$	$B_{\frac{1}{2}}T_{\frac{1}{8}}$	$B_{\frac{1}{2}}T_{\frac{1}{4}}$	$B_{\frac{1}{2}}T_{\frac{1}{2}}$	B_1T_o	$B_1T_{\frac{1}{8}}$	$B_1T_{\frac{1}{4}}$	$B_1T_{\frac{1}{2}}$
End of 6th week ..	100	95	95	98	106	106	99	104	116	107	107	112
End of 14th week ..	184	220	220	213	219	222	236	228	231	243	247	239

Examination of Table 2 which gives the relative heights of plants from the various treatments at the end of the sixth and fourteenth week after final potting, reveals that during the first period the height of plants increased with increased basal dressings of potassium, the best results being obtained from

the 1 oz. dressing. The differences in height existing at the end of the sixth week must be attributed to basal potassium as no top-dressing had been applied up to then. By the end of the fourteenth week the decline in the rate of growth of the no-potassium plants had become more pronounced while the growth rate of those which received heavy basal dressings was still very satisfactory, when allowance is made for the top-dressings applied in the interval. Light top dressings of potassium had a striking effect on the rate of growth where this nutrient was omitted from the base, but heavy top dressings were not additionally effective at any level. At the very high levels of potassium nutrition there was a decrease in vigour as judged by stature, size of leaf and more especially by yield. These results agree with the findings of Wall (8) who recorded increases in heights and yields up to certain concentrations of potassium and corresponding depressions with concentrations above these levels.

Potash deficiency.

The onset of deficiency symptoms was somewhat delayed compared with the previous season and it seems reasonable to attribute this to weather conditions and the presence of the small amount of potassium in the medium already referred to. The first symptoms in the no-potassium plants were observed some four weeks after the final potting and about ten days later than in the previous season. Since the expression of the deficiency symptoms differ somewhat from that recorded by others, a brief description may be of interest. The earliest indication, apart from the dark green foliage which may not be a constant feature, is generally a paling of the apical portion of the distal leaflets. This paling merges to yellow-green, gradually involving the entire leaflet margin or the greater part thereof and extending inwards between the veins towards the centre of the leaflet. Eventually entire leaves become involved. The affected leaflets have a brittle, papery feel, fracture easily and are conspicuous later on by their upturned margins. The margins and the other affected tissues later develop a typical grey-brown scorch. The leaves ultimately wither and fall off. The older leaves near the base are affected first, the symptoms being progressive up the stem. Sometimes, before the typical deficiency symptoms appear, the leaves may be peppered with small reddish-brown spots but, like the dark green colour, this spotting may not be a constant feature. Different stages of the potassium deficiency symptoms will be seen in plate 1, fig. 1.

In this experiment the tops of the no-potassium plants remained normal for a considerable period, though the younger leaves were greatly reduced in size, but eventually the growing points collapsed suddenly and the leaves shrivelled and died. This sudden collapse of the tops occurred in all series where no potassium or basal dressings only, were given. Even those plants receiving the heavy (1 oz.) basal dressing were affected, and though the collapse in this instance took place late in the season, it may nevertheless have influenced the ultimate yield. Bartholomew and Janssen (1) point out that

there is a transference and localisation of potassium in the meristematic and growing regions of plants starved of this nutrient and when physiological disturbances due to potassium deficiency occur in the embryonic regions the amount of this same available for plant growth is nil. Wall (9) states that under conditions of severe potassium deficiency protoplasm will break down resulting in the rapid death of the leaves, while Wallace (10) also mentions that when deficiency of this nutrient is acute, the growing points of plants are severely affected and die-back, and general collapse commonly occurs. It may be assumed, therefore, that the collapse recorded here was due mainly to acute deficiency of potassium, brought about by the heavy demand imposed by the developing fruit. Noteworthy here are the findings of Lewis (4) who records an increase in the potash content of the fruit, at the expense of that in leaf and stem, as the season advances, while Patterson (6) who carried out over 600 analyses recorded as much as 67 per cent. potash in the ash of the fruit. Some factor or factors other than potassium may, however, be connected with the collapse of the growing points. It is interesting to note that such severe deficiency should occur in plants which received such a heavy basal dressing as one ounce, especially since this element is so readily available and is so mobile within the plant. It does suggest that tomato plants utilise large amounts of potassium in the early part of the season and if satisfactory growth and development throughout the season is to be obtained, even very heavy basal dressings may have to be supplemented by top dressings at some critical time or times during the growing season. Evidence up to the present points in the direction of the best results being obtained by combined heavy basal and light top dressings of potassium. The number and the time of application of such top dressings would appear to be very important for, as will be seen later, the continued use of even light dressings, had quite a depressing effect on the yield of ripe fruit. Should extra heavy basal dressings be given in an attempt to eliminate top dressing the danger of luxury consumption of potassium resulting in a deficiency of magnesium within the plant, must be reckoned with. The further development of potassium deficiency symptoms was completely arrested by the light ($T_{\frac{1}{8}}$ oz.) top dressing where no basal potassium had been given as shown by plate 1, fig. 2. With regard to potassium deficiency symptoms on the fruit, there was no clear-cut evidence as uneven ripening occurred at all levels of potassium. Further reference will be made to the latter trouble at a later stage in the paper.

Flower Production and Fruit Development.

It will be seen from Table 3A that the omission of potassium did not interfere with flower production to a great extent. The effect of basal potassium was to cause a slight increase in the number of flowers, in proportion to the amount supplied. There were no appreciable differences, however, between the potassium treatments, but where heavy ($\frac{1}{2}$ oz.) top dressings were given in conjunction with basal potassium the effect was to cause a repression of flower production. Where no basal potassium was given, the greatest response

in flower production was obtained from the quarter ounce top dressing, whereas, the heavy top dressing ($T_{\frac{1}{2}}$) caused a repression as in the other cases.

The position is very different, however, with regard to the effect of potassium on fruit development. Examination of Table 3B reveals that the addition of this nutrient either as basal or top dressing, produced very striking results. There was an increase from basal dressings in proportion to the amount given. The increase brought about by the intermediate basal dressing must be regarded as highly significant, but the further increase from the heavy (1 oz.) dressing was not great. There were no appreciable differences between the potassium treatments. The effect of the light top dressing ($T_{\frac{1}{8}}$) was most pronounced, and caused a highly significant increase in fruit development over the no-potassium treatment. This light top dressing gave the most satisfactory results for the entire season, causing an increase at all levels of basal potassium. Generally, the effect of the heavier top-dressings was either to give no additional increase or to cause a depression.

That a supply of available potassium within the plant is an essential for fruit development throughout the season is clearly shown by reference to Table 4 which gives the percentages of fruit matured from the three uppermost or latest trusses. It will be seen that the light top dressing ($T_{\frac{1}{8}}$) caused marked increases in fruit development for all levels of basal potassium, the effect being most pronounced where no basal dressing had been given. The heavy top dressing gave slight additional and similar increases where no potassium or half ounce basal dressings were given, but led to a depression of a corresponding dimension where the heavy basal dressing (B_1), was applied. While the heavy top dressing (T_1) would appear in this instance to be advantageous, the results for the entire season point in the opposite direction, as such dressings are generally associated with depressed yield, delayed ripening and other undesirable features which will be discussed elsewhere. The evidence with regard to fruit development points to the most satisfactory results being obtained from heavy basal (where the medium is low in potassium) supplemented by light top dressing.

TABLE 3A.

The effect of varying concentrations of Potassium on the number of flowers produced.

	B_0	$B_{\frac{1}{2}}$	B_1
T_0 ..	603	632	676
$T_{\frac{1}{8}}$ ..	595	623	637
$T_{\frac{1}{4}}$ ..	653	660	633
$T_{\frac{1}{2}}$ ..	619	612	653

TABLE 3B.

The effect of varying concentrations of Potassium on the percentage fruit developed.

	B_0	$B_{\frac{1}{2}}$	B_1
T_0 ..	39	61	67
$T_{\frac{1}{8}}$ ..	69	73	76
$T_{\frac{1}{4}}$ ..	69	71	75
$T_{\frac{1}{2}}$ ..	72	77	70

TABLE 4.

The percentage of the fruit developed on the three uppermost trusses.

Potassium Treatment	Per cent. Fruit Matured	Potassium Treatment	Per cent. Fruit Matured	Potassium Treatment	Per cent. Fruit Matured
B_0T_0	21	$B_{\frac{1}{2}}T_0$ ..	51	B_1T_0 ..	55
$B_0T_{\frac{1}{8}}$	62	$B_{\frac{1}{2}}T_{\frac{1}{8}}$ ..	69	$B_1T_{\frac{1}{8}}$ ..	71
$B_0T_{\frac{1}{2}}$ ..	67	$B_{\frac{1}{2}}T_{\frac{1}{2}}$ ..	73	$B_1T_{\frac{1}{2}}$ ..	66

Rate of Ripening of Fruit.

There were no appreciable differences in the times at which picking commenced for the various treatments. At the end of the first thirty days cropping, the difference in weight or number of fruit between the no-potassium treatments and those which received half ounce basal dressings was not appreciable, but the heavy basal dressing (B_1) gave quite a considerable increase in weight and number of fruit picked over this period. The fruits of the no-potassium plants compared favourably in size with those from the potassium treatments, but this tendency towards normal size was not maintained through the season. The effect of the light top dressing ($T_{\frac{1}{8}}$) for the first thirty days cropping was to delay ripening where no basal potassium had been applied. This delay was no doubt brought about by the very considerable growth response obtained from the light top dressings during this period; see text fig. 2 and Table II. Top dressings greater than one eighth of an ounce gave increases in numbers and weight of fruit where no basal potassium was given, suggesting a sufficiency of this nutrient for growth and development of fruit. On the other hand, the effect of top dressings on plants which received the heavy, one ounce basal dressing, was to depress the yields greatly in all cases, the depression being much the same for all dressings. At the intermediate level of basal potassium ($B_{\frac{1}{2}}$) there was a retarding of ripening where both light ($B_{\frac{1}{2}}T_{\frac{1}{8}}$) and heavy ($B_{\frac{1}{2}}T_{\frac{1}{2}}$) top dressings were given. Here also, the retarding effect in the former case was probably due to the high demand imposed by the great increase in growth while in the latter, the slowing down in ripening could probably be attributed directly or indirectly to an excess of potassium within the plant.

At the end of seventy days cropping the position was somewhat different, as shown by Table 5.

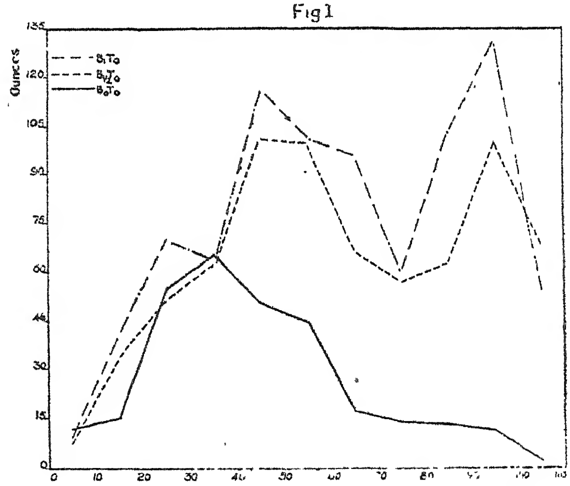
TABLE 5.

Weight of ripe fruit for the first seventy days cropping.

	B_0	$B_{\frac{1}{2}}$	B_1
T_0 ..	263	424	504
$T_{\frac{1}{8}}$ ..	361	466	475
$T_{\frac{1}{4}}$ ..	382	442	432
$T_{\frac{1}{2}}$ ..	391	394	393

All treatments were significantly better than no-potassium, the highest yield having been obtained where the heavy basal dressing had been given. without any added top dressing (B_1T_0). In fact the rate of ripening, as measured by numbers and weight of fruit. increased in proportion to the

Fig 1

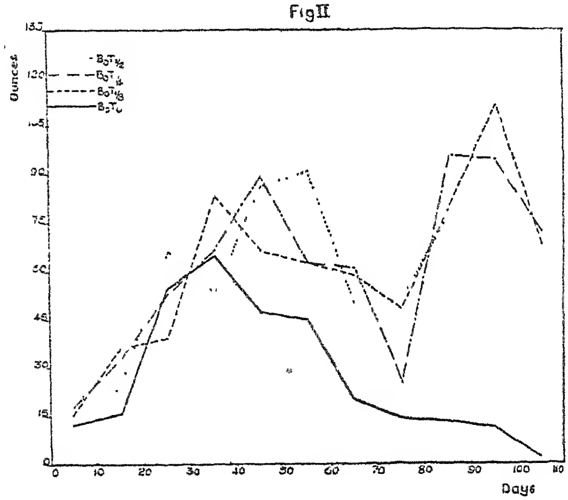


amount of potassium given in the base. The effect of added top dressings was to increase the yields where no basal potassium was given and to cause a depression where the high (1 oz.) basal dressing was given. The respective increase and depression was in proportion to the amount added. At the intermediate level of basal potassium there was an increase in weight and number of fruit by the addition of the light top dressing ($T_{\frac{1}{8}}$), but the heavier dressings led to a falling off as in the case of heavy basal treatments.

If the amounts of ripe fruit picked from the different treatments at the end of seventy days are compared with their respective final totals it will be seen from Table 6 that the no-potassium plants had by then practically finished cropping. While basal potassium only, as against no-potassium had the effect

of extending the fruiting season (see text fig. 1) the same tendency towards a shortening of the fruiting season is apparent, though to a much lesser extent, where such basal dressings were not supplemented by top dressings. It has been established by other workers that plants lacking ample supplies of potassium will tend to mature their fruit within a shorter period than those with a sufficiency. The present work corroborates these conclusions. Development of fruits takes place in such cases at the expense of growth, while the reverse is frequently the case in the early season. Wall (9) points out that there is a high drain on the potassium reserves by the fruit and that almost all the available potassium is translocated to the fruits in plants supplied with

FigII



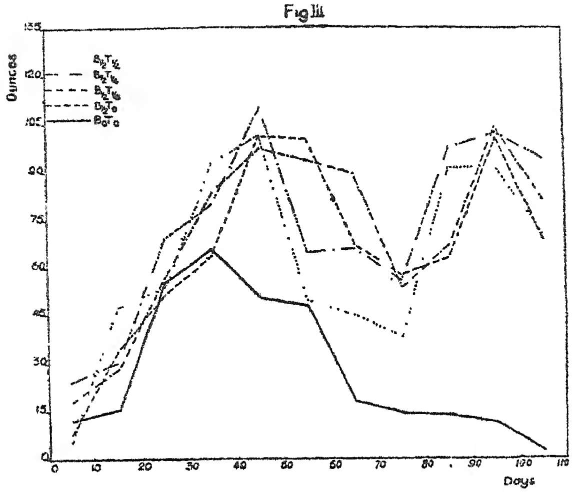
Effect of Potassium on Length of Cropping Season
FigI Basal Dressings Only FigII Top Dressings Only

small quantities of this nutrient. It is reasonable, therefore, to expect a shorter fruiting season from plants receiving no potassium or basal dressings only. In such plants the ever diminishing supply of available potassium is presumably transferred to the fruit in such quantity as seriously to interfere with setting on the upper trusses, particularly in the (B_0T_0 and B_1T_0) treatments, and to cause such a severe check to growth as to result in the ultimate collapse of the growing points. See plate 2.

In contradistinction to this, at the high levels of potassium nutrition (*i.e.*, where combined heavy basal and top dressings were given) the rate of ripening was delayed and such delays were commonly associated with a depression in yields. There was a noticeable slowing up in the rate of ripening in all treatments midway through the season and this persisted for about thirty days. This is a natural occurrence and has been shown to be caused by the twofold demand on nutrients for growth and development of fruit. At this time of the season the plants are developing their maximum weight of fruit and consequently growth is much restricted. It will be observed that where basal potassium

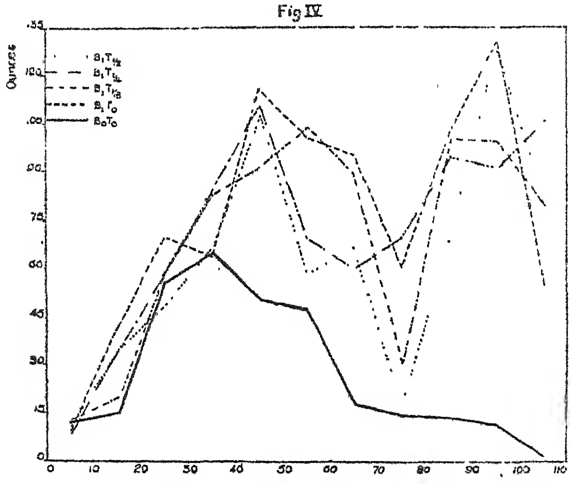
was given, the effect of heavy top dressing was to accentuate this delay in ripening during the mid-season lag. Reference to text figs. III and IV will make this point clear.

Fig III



It would appear, therefore, that heavy basal dressings have the most beneficial influence on the rate of ripening, but if even light top dressings are added (commencing at the usual time, *i.e.*, when the second truss is setting) the effect is to retard ripening. Where a heavy basal dressing such as one

Fig IV



Effect of Potassium on the Rate of Ripening
Fig III Medium Basal and Six Top Dressings
Fig IV Heavy Basal and Six Top Dressings

ounce per plant is given top dressing might with advantage be delayed until a later stage of development. It is not clear whether the delay in ripening cited here and elsewhere, is due to the time at which top dressing was com-

menced or to the repeated use of such dressing throughout the season. It is hoped to obtain further information on these matters and experiments with this object in view are being carried out.

TABLE 6.

Weight of crop picked at seventy days as a percentage of the total crop of ripe fruit.

	B_0	$B_{1/2}$	B_1
T_0 ..	86.7	60.9	60.9
$T_{1/8}$ ..	58.0	57.5	59.2
$T_{1/4}$ ..	57.1	57.1	59.9
$T_{1/2}$ ..	55.5	57.5	57.5

Total yields of ripe fruit.

When the experiment was terminated the resulting yields, given in Table 7, were in much the same order as obtained at the end of seventy days cropping. The final yield of the no-potassium plants was very significantly lower than from any of the potassium treatments. The effect of the base dressing was highly significant, the highest yield of ripe fruit having been obtained from the heavy basal dressing (B_1). The increase in yield was in proportion to the amount given in the base. (This same trend was noticeable in the 1941 experiment though the yields of some of the plants which received heavy basal potassium were greatly reduced owing to the plasmolysis already referred to). The yield from the plants which received the one ounce basal dressing without added top dressing, *i.e.*, B_1T_0 was significantly better than from any of the series which received no basal but top dressings only, and probably was significantly better than the yields from either the $B_{1/2}T_{1/2}$ or $B_1T_{1/2}$ treatments.

The effect of added top dressing was most noticeable where potassium was omitted from the base, but for any given level of basal potassium, there were no significant differences between the treatments. It will be seen from Table 7 that no additional response was obtained from top dressings greater than one eighth of an ounce. At the lower levels of basal potassium the effect of top dressings greater than one eighth of an ounce was to cause a depression in yield in all but one instance ($B_{1/2}T_{1/4}$), the depression being proportional to the amount added. Where the high basal dressing B_1 was given, even the light top dressing ($T_{1/8}$) had a considerable depressing effect on the total yield of ripe fruit, while the heavy top dressing ($T_{1/2}$) caused a significant decrease as already mentioned. With regard to the depressing effect on yield of ripe fruit caused by the top dressings referred to here, it must be stated that there is not sufficient evidence to show whether such depression were induced by the

quantitative nature of the dressings or by their continued use through the season. It has already been pointed out elsewhere, that the growing points of the plants which received only basal dressings of potassium ($B_{\frac{1}{2}}T_0$ and B_1T_0) collapsed towards the end of the season. It is highly probable that if such plants were given *one* or *two light* top dressings at the critical time or times, not only might this collapse have been averted, but greater yields of ripe fruit might have been obtained due to improved setting of the top trusses coupled with larger fruits at the end of the season.

TABLE 7.

Total yields (oz.) of ripe fruit from all treatments.

	B_0	$B_{\frac{1}{2}}$	E_1
T_0 ..	304	696	852
$T_{\frac{1}{8}}$ ..	674	769	787
$T_{\frac{1}{4}}$ ..	669	791	794
$T_{\frac{1}{2}}$ ..	651	683	685

Sig. diff. 171 oz.

Final total yields—ripe and green fruit.

It will be seen from Table 1 that while increased basal dressings of potassium gave a proportional increase in the final total yields, highest yields were obtained from combined heavy basal and light top dressing $B_1T_{\frac{1}{8}}$. With regard to the effect of top dressing, no further response was obtained from dressings greater than one eighth of an ounce at any level of basal potassium. At the higher levels of basal potassium, the effect of the heavy top dressing ($T_{\frac{1}{2}}$) was to cause a depression in the total yield. This depression was of considerable magnitude where the heavy one ounce basal dressing had been given. It is of interest to note that the final total yield from the plants which received combined heavy basal and top-dressings ($B_1T_{\frac{1}{2}}$) was actually lower than the yield of ripe fruit obtained from the plants which received the heavy basal dressing only (B_1T_0). It must be conceded however, that it is unlikely that such a number of heavy top dressings as were applied here, would be given in any one season. Nevertheless, it is not uncommon to find as much as three thousand pounds per acre of potassium sulphate used year after year in the production of the crop under commercial conditions. Owen (5) points out that a forty ton crop, which is a good average one, removes 672 lb. of potassium per acre, corresponding approximately to 1,400 lb. of potassium sulphate, while Lewis (4) states that a fairly good crop removes 600-700 lb. of potassium per acre.

It is not difficult, therefore, to visualise an abnormally high concentration

of potassium in soils treated in such manner as there is bound to be an accumulation of residual potassium from year to year. Cases have been recorded in this country by Walsh and Clarke (11) where tomato soils in which severe potassium-induced chlorosis occurred in association with poor cropping, contained as much as two thousand pounds per acre of easily available potassium. The growers in these instances were following the recognised principles of tomato nutrition and accordingly in preparation for the next season's crop, would further augment by a heavy basal dressing, the supply of potassium in soils already having an excess.

The conditions brought about by the repeated heavy, annual, dressings of potassium given in commercial practice are, to a great extent, comparable with those obtaining at the high levels of potassium nutrition in these experments. It is reasonable, therefore, to expect that features attendant on the high levels of potassium manuring here reported, such as reduced yields (consequent on reduction in setting of flowers and size of fruit) delayed ripening, and uneven ripening would also be characteristic of the commercial conditions cited above. In fact, it is true to say that there is concrete evidence of depressed yields, due to small fruit, under commercial conditions where potassium has been used in large quantities for some years. Apart from these disadvantages there is the danger of a potassium-induced chlorosis which can have most serious consequences on vigour and cropping. It is also conceivable that the continued use of heavy dressings of potassium could bring about a soil condition unfavourable for root action, for part of the season at all events, by inducing a salt concentration in the soil of sufficient magnitude to interfere seriously with normal root development. Such a condition would most probably occur in the early part of the season when water is used sparingly, but later in the season there would tend to be an improvement in root action brought about by the leaching of these salts to the subsoil, through heavy waterings. Plant roots in such an unfavourable environment would be susceptible to attack by one or other of the many parasitic organisms such as root rot fungi which may be present in the soil. This adverse soil condition could become more accentuated from year to year, for in the course of the deep cultivation given in preparation for tomatoes much potassium would be brought to the surface regions where most of the feeding roots would be located.

While it is true that the highest final total yield of fruit was obtained from the $B_1T_{\frac{1}{2}}$ treatment, it is also worthy of note that the greatest weight of green fruit was picked from this same treatment. It will be seen from Table 8 that the weight of green fruit was proportional to the amount of potassium given in the base, but the amount from any treatment receiving basal potassium only, was not great. The immediate effect of top dressing was to cause a very striking increase in the weight of green fruit obtained. The light top dressing ($T_{\frac{1}{2}}$) gave the most marked increase at all levels of basal potassium. Where no potassium or the half ounce dressing only was given in the base,

the effect of the heavy top dressing ($T_{\frac{1}{2}}$) was to cause further considerable increases in the weight of green fruit. The combined heavy basal and top dressing ($B_1T_{\frac{1}{2}}$) on the other hand gave a considerably lower yield of green fruit than was obtained from combined heavy basal and light top dressing, but this decrease in green fruit was associated with depressed final total yield.

From the point of view of final total yields, therefore, it would seem that combined heavy basal with light top dressing would give best results in a medium with a low potassium content. In these experiments such treatments were somewhat disappointing, as 22 per cent. of the total crop failed to ripen. This failure to ripen of a greater percentage of fruit may possibly be due to the continued use of such light top dressings throughout the season. On the other hand, the high percentage of unripe fruit, coupled with depressed yields obtaining at the very high levels of potassium, points clearly to the fact that nothing is gained by continued heavy dressings of this nutrient during the growing season. The futility of continued heavy top dressing is all the more apparent when heavy basal dressings are given.

TABLE 8.

Yields (oz.) of green fruit from the varying concentrations of potassium.

	B_0	$B_{\frac{1}{2}}$	B_1
T_0 ..	2	25	45
$T_{\frac{1}{8}}$ ..	161	173	216
$T_{\frac{1}{4}}$ ..	158	158	178
$T_{\frac{1}{2}}$ ..	189	200	157

Size of fruit.

It was stated earlier in this paper that the fruits from the no-potassium plants were almost as large as those from the potassium treatments, in the early part of the season. That this tendency was not maintained is clearly shown in Table 9. The omission of potassium from the base had a considerable depressing effect on the size of fruit throughout the cropping season.

TABLE 9.

The effect of varying concentrations of potassium on the average size (*i.e.*, weight in grammes) of fruit.

	B_0	$B_{\frac{1}{2}}$	B_1
T_0 ..	1.31	1.92	2.05
$T_{\frac{1}{8}}$ ..	2.05	2.08	2.09
$T_{\frac{1}{4}}$ ..	1.82	2.04	2.02
$T_{\frac{1}{2}}$ ..	1.88	1.88	1.89

There was an increase in size proportional to the amount given in the base, but the heavy one-ounce basal dressing produced only a very slight additional increase over the intermediate basal dressing ($B_{\frac{1}{2}}$). The effect of added top dressing is very marked, where no basal potassium was given. The light top dressing ($T_{\frac{1}{8}}$) increased the size of fruit still further where basal dressings had been given but such increases were not significant. There was a negative response to top dressings greater than one-eighth of an ounce, at all levels of basal potassium. This is especially true when considering the average size of fruit over the season. Towards the end of the cropping season, however, the size of fruit from those plants which received basal potassuim only, was noticeably smaller than from the plants which received basal combined with light top dressings. For the final twenty days picking, the fruits from the B_1T_0 treatment were smaller than from the $B_{\frac{1}{2}}T_0$ treatment, and were, on the average twenty-five per cent. smaller in size than from the $B_1T_{\frac{1}{8}}$ treatment. Reference to the total numbers of fruit picked from the different treatments reveals why the end of the season fruit from the B_1T_0 treatment were smaller than from the $B_{\frac{1}{2}}T_0$ treatment. The findings in general here are in accordance with those of Wall (8) who records an increase in size of fruit with increased concentration of potassium up to a certain point, but a decrease at higher concentration.

Reviewing the results of growth response, fruit development rate of ripening, size of fruit and yields, it becomes apparent that the response from the continued use of heavy top dressings, is a negative one for all basal potassium treatments. Furthermore, the continued use of even light top dressings throughout the season can produce unsatisfactory results, particularly where heavy basal dressings had been given, as evidenced by the retarding effect of such treatment on ripening. It has, of course, been established by many workers, that tomato plants can absorb much more potassium than is necessary for their normal requirements. It would appear that when a more or less continuous supply of potassium is available, plants growing under favourable conditions absorb it in such quantities as may not only give no proportional response but may actually produce results detrimental to growth, vigour and

cropping. Some idea of the negative response obtained from plants with a high internal concentration of potassium is conveyed in Table 10. It should be stated that the samples for analysis were taken at the end of the season, but owing to limited facilities it was only possible to carry out analysis on certain of these, the results of which are presented below. These samples were taken from corresponding portions on the upper and lower stems, the point of demarkation between upper and lower stem being fixed arbitrarily. In the case of the no-potassium plants, no differentiation into upper and lower leaf sample was made, because these plants were so greatly reduced in size that practically all of their small withered leaves had to be taken to give sufficient bulk for analysis. This, together with the fact that the yield from such plants was so low, helps to explain the apparently high potassium content of the leaves in comparison with that in the more vigorous heavier yielding plants, which received basal dressings only of potassium. The drain on the available potassium for growth and fruit development was much greater, especially in the case of the B_1T_0 treatment which gave such a heavy yield of fruit.

The tops of the plants, as shown by Table 10, were in general,, richer in potassium than the lower portions, especially where repeated dressings were given during the season. When the potassium content of the leaves is considered in conjunction with the yield of ripe fruit it will be observed that basal potassium as against top dressing only, is of vital importance. Comparison of the $B_{\frac{1}{2}}T_0$ and B_1T_0 treatments with either the B_0T_0 or the $B_0T_{\frac{1}{2}}$ treatment makes this point clear. Of particular interest is the fact that the potassium content of the leaves from the $B_0T_{\frac{1}{2}}$ treatment was more than double that in the B_1T_0 treatment, while the yield of ripe fruit from the latter was significantly better than from the former treatment. It will be noted that for a given level of basal potassium, the amount of this nutrient present in the leaves increased in proportion to the total amount supplied. These increases in internal potassium were associated with proportional depressions in yield as shown by comparison of the B_1 treatments with and without added top dressings. Clearly, those plants which received the combined heavy basal and top dressings (B_1T_1) absorbed potassium in quantities so great as to interfere seriously with fruit development. Under commercial conditions, where potassium is used to such an extent as previously mentioned, (3,000 lb. per acre per annum) it is almost inevitable that the plants absorb quantities greatly in excess of their normal requirements and perhaps to such an extent as may produce the serious consequences reported here.

Also, it is worthy of note that the absorption of other minerals was seriously interfered with at the high levels of potassium nutrition and this may be a potent factor in bringing about certain of the undesirable features reported here. Even the light top dressing ($T_{\frac{1}{2}}$) had a very considerable depressing effect on the uptake of other minerals, while the heavy top dressing (T_1) had a very adverse effect in this respect. In this as in other instances already mentioned, the adverse effect

may be linked closely with the continued use of such dressings of potassium throughout the season. The ash percentage was higher in the lower leaves than in the upper, in all cases. The difference of the total ash in upper and lower leaves was of considerable magnitude where basal potassium only was given and was probably due to the very great drain by the developing fruits on the available potassium in the upper leaves. Top dressing only, lessened the divergence between total ash of upper and lower leaves, as also did combined basal and top dressing, but in a more pronounced manner. The effects produced here either by top dressing or by combined basal and top, are no doubt connected with the higher internal potassium of plants receiving such treatments, which in turn has a depressing effect on the uptake of other minerals, and hence the lower ash fraction.

TABLE 10.

Potassium content of upper and lower leaves from some of the treatments.

Potassium Treatment	Total Potassium Sulphate applied ozs.	Leaf Sample	Percentage Ash	Percentage Potash	Percentage other Minerals (Ash–Potash)	Ratio of other Minerals to Potash	Yield of ripe fruit ozs.
B_0T_0 ..	Nil	Composite Sample ..	26.00	1.13	24.87	22.01	304
$B_{\frac{1}{2}}T_0$ ..	½	Upper Leaves	19.20	.91	18.29	20.09	696
		Lower Leaves	29.80	.73	29.07	39.82	
$B_0T_{\frac{1}{4}}$ ..	¾	Upper Leaves	20.30	2.53	17.77	7.02	674
		Lower Leaves	26.30	2.03	24.27	11.39	
B_1T_0 ..	1	Upper Leaves	21.10	1.04	20.06	19.29	852
		Lower Leaves	32.00	1.16	30.84	25.72	
$B_1T_{\frac{3}{4}}$ ..	1¾	Upper Leaves	21.20	2.87	18.43	6.39	787
		Lower Leaves	26.26	2.78	23.48	8.41	
$B_1T_{\frac{3}{4}}$ ..	4	Upper Leaves	23.00	6.10	16.90	77.2	685
		Lower Leaves	26.80	5.27	21.53	09.4	

Other aspects studied.

During the course of these experiments certain other features which may be of interest were studied: amongst these were the following :—

(*a*) incidence of uneven ripening in relation to potassium;
(*b*) incidence of certain other disorders in relation to potassium;
(*c*) effect of potassium on position of plants during the growing season.

Uneven Ripening.

There was no definite relationship between potassium and the incidence of the form of uneven ripening commonly referred to as *blotchy ripening*. Fruits affected with this trouble are characterised by having green or greenish-white areas when the remaining portions are red. Such affected areas may occur on any part of the fruit and never colour properly, ultimately changing to orange. While it is true that some fruits of the no-potassium plants were blotched, the fruit in general from these plants coloured evenly, though the degree of red pigmentation was not so intense as in most of the potassium treatments. As previously stated, the fruits from the no-potassium plants were a less intense green in the immature state and finished orange-yellow as against red in the case of the potassium-treated plants. A certain amount of blotchy ripening occurred at all levels of potassium during the course of these experiments. It is worthy of note, however, that in the 1941 season when the total sunshine during the experiment was greater than in the 1942 season, there was less blotchy ripening in all treatments.

The observations here are not quite in agreement with the findings of Bewley (2) who states that blotchy ripening is the result of malnutrition in respect of potassium and nitrogen, especially the former. He also suggests, however, that factors probably climatic in nature, play some part in the incidence of this disorder. The present work, which infers that sunlight is more important than potassium in reducing blotchy ripening, is in accord with that of White (13) who suggests that this trouble is not due directly to lack of potassium or nitrogen, but to deranged carbohydrate metabolism which is counteracted by increase of light. It is suggested, therefore, that tomato houses should be placed on such sites and be of such construction as would admit the maximum of light. Furthermore, it is very important to avoid overcrowding of the plants and it is the writer's opinion that it is much more desirable to achieve better light conditions by giving plenty of room at planting, than by endeavouring to achieve this end through drastic defoliation later on. Where plants are overcrowded or where light conditions are poor, it is probable that blotchy ripening will occur even though the supply of available nutrients is ample.

The other common form of uneven ripening known as '*green back*' was also observed. In this case only the calyx end of the fruit is affected, remaining green when the other portion of the fruit is red. The green tissues ultimately turn an orange colour. In connection with this disorder, it is to be noted, that two forms of 'green back' were distinguished. On the one hand the trouble was connected more closely with sunshine than potassium, and on the other hand, potassium more than sunshine, appeared to be the chief contributing factor. That, due to sunshine, occurred independently of the level of potassium nutrition where fruits were exposed to direct sun. The calyx end of such affected fruits presented a grey-green appearance, faintly tinged bronze, and this condition continued to a great extent, when the rest

of the fruit was red. The affected tissues, which were soft to touch even in the early stages, never coloured properly, but changed to orange or orange-yellow, contrasting sharply with the red tissue. This softness, which was quite pronounced when the fruit was ripe, together with the fact that the dividing line between the orange and red tissues was rather abrupt, help to distinguish the present, from the later-described form of the disorder in which the affected tissues were firmer, especially in the early phases, and the transition from orange to red tissue was more gradual. It seems worthy of note that in certain cases some fruits on a truss, frequently the distal ones, would be affected while the others, which were seen to be afforded shade by a leaf or leaves, appeared quite normal. Also, the fruits on the shaded side of plant would be perfectly free from green back, while those exposed to the sun would be affected, the severity of the trouble depending on the degree of exposure, and of course, the intensity of sunshine.

The incidence of the other form of ' green back ' was related to a high level of potassium nutrition and occurred even on the lower trusses on the northern side of plants, which precludes the possibility of exposure to direct sun. The immature fruits of the high potassium treatments were, in general, a darker green than those of the lower levels, while the calyx end of such fruits was conspicuous by an intense greening as compared with corresponding areas on the fruits from the lower potassium treatments. This greening (' green back ') persisted to a great extent after the remainder of the fruit had coloured red, the calyx end presenting a dark green-splashed-red appearance which gave way ultimately to an orange-yellow colour. The affected tissues were quite hard in the early stages and at all times were firmer than those of the aforementioned ' green back.' It is quite possible that factors other than potassium are involved, but nevertheless, it is of interest to note that this form of ' green back ' has been observed only at the high levels of potassium manuring, irrespective of exposure to sunshine.

The observations here also with regard to ' green back ' are somewhat at variance with the findings of Bewley (2) who states that " susceptibility to this disorder bears in general the same relation to environmental factors as blotchy ripening, being increased by a deficiency of potash and nitrogen, but the ultimate symptoms seem to be intensified by exposure of the fruits to strong sunlight." It cannot be conceded that there was more ' green back ' in the low potassium series, in these experiments, but it is quite possible to conceive that under conditions of more intense sunshine than those obtaining here, plants lacking sufficient potassium would be more liable to ' green back ' owing to the greatly reduced leaf area of such plants, and the consequent greater exposure of the fruits to the sun. It is also conceivable that in low houses, owing to the proximity of the fruits to the glass, the incidence of ' green back ' might be accentuated, particularly in plants lacking potassium.

It is probable that this disorder, too, is connected with deranged meta-

bolism which may be brought about either by exposure to direct sunshine, irrespective of the amount of potassium given, or by an excess of available potassium, regardless of exposure to sunshine. Care in the use of potassic fertilisers, together with judicious application of the pruning knife when defoliating, should help considerably to reduce the incidence of 'green back.'

Other Disorders.

Blossom End Rot.

There was evidence in the 1941 experiment and in subsequent work which will be reported later, pointing to the fact that high potassium manuring can be a contributory factor to the physiological disorder known as blossom end rot. Additional evidence to this effect has been obtained through visiting commercial establishments. It will be noted that the occurrence of this trouble in the 1941 experiment was coincident with a high total salt concentration and was absent from the no-potassium treatments. Furthermore, it would seem that the use of ammonium salts in conjunction with high potassium manuring, brings about conditions which are conducive to the development of blossom end rot, for when the use of ammonium sulphate was discontinued in the 1941 experiment, the further development of the trouble was arrested.

Chlorosis.

As already reported, a chlorosis of the foliage occurred at the higher levels of potassium nutrition during the 1941 experiment. For the conditions of the experiment, such chlorosis was coincident with a potassium content of from 11 per cent. to 13 per cent. of the oven dry weight of the foliage. During the 1942 experiment there was a recurrence of this chlorosis although the symptoms were not at all so pronounced, even in plants which received more potassium than was given to any during the previous season. It is of interest to note that the disorder was not confined to the high potassium treatments, in the latter season, but occurred to a lesser degree even where no basal, but light top dressings only, were given throughout the season. The most pronounced symptoms, however, were apparent at the high levels of potassium. The fact that chlorosis was not so marked in the 1942 season may possibly be attributed to the less favourable growth conditions, particularly in the early part of the season, with consequent lower absorption of potassium. The weather for the greater part of the 1942 experiment was colder and the total sunshine was considerably less than during the 1941 experiment, so that growth was greatly restricted in the former season, especially in the early stages, as compared with the 1941 season. That chlorosis should occur, though to a less extent, at much lower levels of potassium under the conditions of reduced sunshine in the 1942 season, suggests that this nutrient is not utilised to the same extent under such conditions and tends to accumulate in the leaves, with results detrimental to growth and cropping. This accumulation in the leaves was connected with potassium applies as top dressing rather than basal, as there was no evidence to connect basal potassium alone, with the incidence of chlorosis. Of course, if the basal dressing had been so

great as to ensure a supply throughout the season, it is probable that chlorosis would occur. It appears that under conditions of a continuous supply of available potassium, particularly after a heavy basal dressing, the occurrence of chlorosis is almost unavoidable.

Viewed, therefore, from many aspects, it seems undesirable that potassium should be used regularly without reference to the amount already present in the medium, as such practice may lead to its absorption in quantities not only above the normal requirements of the plant, but which may produce unsatisfactory results in a number of ways.

Botrytis.

Regarding the incidence of the fungus disease, botrytis, it is worthy of note that the no-potassium plants were much more susceptible than those having a sufficiency of this nutrient. Furthermore, the no-potassium plants were more adversely affected by low temperature conditions than were those which received potassium.

Potassium and Position of Plants.

In general, the growth, vigour and cropping of path plants was disappointing compared with adjacent (non-path) plants in their respective series. This was an unexpected result and may probably be attributed to the fact that the normal growth and development of such plants was interfered with, owing to mechanical injury suffered through contact with the workers, during the various operations. These plants consequently were looked upon as the least favourably placed and it is of interest to note that the yield of ripe fruit from such plants was greatly influenced by potassium treatment. The yields increased in proportion to the amount given in the base, the highest yield having been obtained from the heavy basal treatment (B_1T_0). A negative response was obtained from top dressings greater than one eighth of an ounce, for all levels of basal potassium. At the very high levels of potassium there was a marked decrease in yield of ripe fruit compared with the B_1T_0 treatment. All potassium treatments were markedly better than no potassium.

Of interest also is the fact that treatments in general, in the northern and central portions of the house, gave considerably lower yields than their counterparts in the southern portion. In the case of the no-potassium plants the yield from the central section was markedly lower than from either the northern or southern section. In all sections there was an increase in yield in proportion to the amount of potassium given in the base, the greatest response having been obtained in the southern section. At the high levels of potassium there was a depression in yields in all sections, this being most pronounced in the central section.

The evidence here suggests that potassium, up to a certain concentration,

will improve the cropping of unfavourably placed plants, but that heavy dressings of this nutrient can cause a depression in yield from such plants. Further, that improved conditions of light and air circulation lead to better cropping of tomato plants as shown by the greater response obtained from the no-potassium treatments in both northern and southern portions where, it must be conceded, the plants were more favoured in these respects. Also, if beneficial results are to be obtained from applications of potassium, the amount given should be gauged in accordance with the soil requirements of this nutrient, and arrangement of plants should be such as would admit the maximum of light, as under such conditions potassium will be utilised to the greatest advantage.

General Discussion of Results.

The results of these experiments corroborate the findings of other workers regarding the fundamental importance of potassium for satisfactory growth, vigour and cropping of tomato plants. This is clearly indicated by the stunted growth, reduced setting of flowers, undersized fruits, reduced yields and succeptibility to diseases, such as botrytis, of the no-potassium plants. From every aspect studied here it is very evident that a supply of potassium within the plant, throughout the season is a pre-requisite to normal growth and development. This does not mean that regular applications should be given during the season or that a constant supply should be maintained in the root region. In fact, the results here suggest that the continued use of even light dressings, may only produce unsatisfactory results. It has been established by many workers, that tomato plants can absorb large quantities of potassium in the early stages of growth and also that owing to its extreme mobility within the plant, this nutrient can be translocated from the older leaves to the younger ones or to the points where the demand is greatest. It is very important, therefore, that a supply of potassium should be available in the early stages as there is no doubt about the superiority of basal dressings of this nutrient over later applications, in producing satisfactory growth and cropping. This is evident from the good response obtained from treatments in general, which received basal dressings, and more especially from the excellent response from plants which got basal potassium only.

In a soil or medium, low in potassium, such as the one used in these experiments, a positive response may be expected from basal dressings up to one ounce per plant or 1,000 lb. per acre of potassium sulphate for a 16,000 per acre plant. Indeed, for conditions such as cited, a 1,000 lb. per acre dressing would appear to be most satisfactory. No additional response is likely to be obtained from basal dressings in excess of this amount but, on the contrary, detrimental results may follow where extra heavy basal dressings are given. It has been pointed out by other workers, and it is also shown conclusively in these experiments, that tomato plants can absorb potassium in quantities not only in excess of their normal requirements but which may produce results deleterious to health, vigour and cropping.

It is highly probable that an extra-high external concentration of potassium, in the soil or medium, as opposed to a high internal concentration, may equally well be responsible for unsatisfactory growth and cropping, by constituting an unfavourable environment for normal root action. The latter situation is more likely to occur under conditions favourable to active growth and development, particularly in the early stages, while the former is more probable where growth conditions are unfavourable.

In commercial practice, therefore, basal dressings should always be gauged in accordance with the amount of available potassium in the soil or medium and in the light of the potassium requirements of the crop. The continued use of heavy dressings of potassium, according to a set formula, and without any reference to soil or crop requirements, cannot be recommended and must inevitably produce unsatisfactory results. Before planting, growers would be advised to ascertain the potassium status of the soil if possible, and as a consequence, to adjust the basal dressing of this nutrient so that readily available potassium may be present in a concentration approximately equivalent to that supplied by a dressing of 1,000 lb. per acre of potassium sulphate. Such a basal dressing however, would not be sufficient to ensure optimum results throughout the season but should be supplemented by top dressing at a certain critical time or times, as yet not determined. The present work suggests that when a basal dressing of the above nature is given, the greatest response will be obtained from light top dressings at the rate of 125 lb. per acre or one eighth of an ounce per plant. It would seem that no additional response would be obtained from top dressings in excess of this amount. The number of such top dressings and the stage at which they should commence would appear to be very important, as the use of even the light, one eighth ounce, dressing caused a considerable delay in ripening of fruit in the early part of the season, while its continued use led to as much as 22 per cent. of the total crop being in the state green at the termination of the experiment on November 13th. As stated elsewhere, had the number of top dressings been one, two or perhaps three, instead of six, as given here, the results from such treatments would probably be very different. Furthermore, it is probable that when a suitable basal dressing of potassium is given, top dressing might with advantage be delayed to a later stage of plant development than the setting of the second truss, as evidenced by the delay in ripening, consequent on application commencing at that stage. In commercial practice, it is usual to give a heavy top dressing of potassium at this stage with the main object of counteracting the rank growth following the flooding, which coincides with such dressing. It is the writer's opinion that this heavy top dressing may be unnecessary and that rank growth could be avoided by judicious watering, gradually increasing the amount until there is sufficient fruit set to curb growth automatically. Ventilation and manurial treatment should also play an important role in maintaining a favourable growth-fruit balance.

In practically all cases, there was no response to top dressings greater than one eighth of an ounce per plant or 125 lb. per acre. For all levels of basal potassium there was a negative response to the continued use of heavier top dressings. This negative response was most marked where the heavy basal dressings of potassium were supplemented by heavy top dressings. The frequent use of a top dressing as great as half an ounce per plant or 500 lb. per acre of potassium sulphate cannot be advocated even where no basal potassium had been given. It is not uncommon to find as much as 3,000 lb. per acre or even greater quantities of potassium sulphate used annually in commercial establishments and since it has been established that a good average tomato crop will remove approximately 670 lb. of potassium per acre, it is inevitable that an accumulation of this nutrient should occur in such soils even allowing for a considerable loss in drainage.

In these experiments, the greatest amount of potassium sulphate given during the season was four ounces per plant or 4,000 lb. per acre. The returns from the latter plants were most disappointing, the yields being significantly lower than from plants which received but quarter the amount of potassium during the season. Poor yields were not by any means confined to the 4,000 lb. per acre treatments, but were associated with much lower concentrations of potassium, while heavy top dressing and depressed yields were definitely correlated. While it is apparent from this and other work that tomato plants can absorb potassium in proportion to the amount supplied, it is still more obvious that there is a negative correlation between yields ,and the internal potassium content of the plants. Apart from depressed yields, features such as reduced setting of flowers, smaller fruits and delayed ripening were associated with the high levels of potassium, while the uptake of other minerals was depressed. It is worthy of note that most of these same features were characteristic of the no-potassium plants. Under conditions, therefore, where potassium is used in such quantities as 3,000 lb. per acre annually, there is bound to be an accumulation in the soil which, in turn, may not only give no proportional response, but may actually produce results inimical to healthy growth, vigour and cropping. Added to the disadvantages cited here in connection with a high potassium concentration in the soil or medium, is the danger of a potassium-induced chlorosis, with its own attendant evils.

There was no clear-cut relationship between potassium and the physiological disorder known as blotchy ripening as a certain amount occurred at all levels of potassium. There was, however, evidence correlating this disorder with sunlight, the trouble being aggravated under conditions of poor light and notably reduced or absent entirely under improved conditions of light and air circulation. Regarding the fruit disorder referred to as 'green back,' two forms of the trouble were distinguished—one of these forms was connected with exposure of the fruits to direct sun, rather than with potassium,

and occurred at all levels of potassium. It is probable that this form of ' green back ' would, under conditions of intense sunshine, be more serious on plants lacking potassium on account of the greatly reduced leaf surface of such plants, and the consequent greater explosure of the fruits. The other form of ' green back ' was coincident with high levels of potassium nutrition, regardless of the position of the fruits relative to sun. Attention is called (elsewhere) to some differences in appearance between the two forms. It is probably true to say that both blotchy ripening and ' green back ' are due to deranged metabolism, brought about mainly by insufficient sunlight in the case of the former trouble and by exposure of fruit to direct sun or by an excess of potassium in the case of the latter disorder.

The omission of potassium led to an increase of diseases such as botrytis, and lowered the resistance of plants to low temperature conditions.

SUMMARY.

A study has been made of the effects of varying concentrations of potassium on the growth, vigour and cropping of tomato plants of the variety Potentate. The importance of potassium for satisfactory growth and cropping is emphasized. Attention is drawn to the fact that according to the recognized principles of nutrition, potassium may be used in quantities so much in excess of the requirements of the crop as may lead to an accumulation of this nutrient, both in the plant tissues and in the soil or medium. Features associated with high levels of potassium nutrition are mentioned and the undesirable consequences attendant on the continued use of heavy dressings of potassium are pointed out. Recommendations are made in respect of the use of potassic fertilisers with a view to obtaining the fullest utilisation of such. Suggestions are put forward as to suitable dressings of potassium, both basal and top, for particular conditions. The use of potassic fertilisers in accordance with a fixed formula, is to be avoided. Basal dressings, in particular, should always be gauged in accordance with the potassium content of the soil or medium, while top dressings should be limited in quantity and number. At all times a balanced form of nutrition should be aimed at.

The results presented here can, in the strict sense only, be interpreted for the variety Potentate, but no great departure from the amounts of potassium suggested seems warranted for varieties of equal vigour. The demand may, however, be somewhat greater for vigorous varieties like Scarlet Knight and Victory, and the experience here seems to indicate that such extra potassium if required, would be utilised to greater advantage if applied by way of additional light top dressing rather than through a very heavy basal dressing.

PLATE 1.

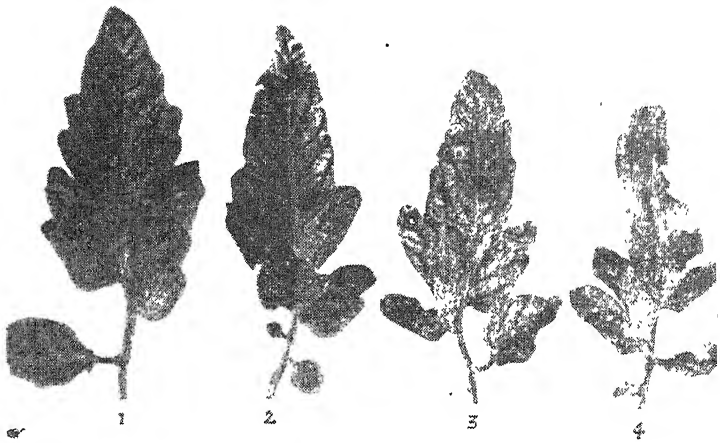


Fig. 1. Different stages of potassium deficiency.
Left (1). A normal leaflet.

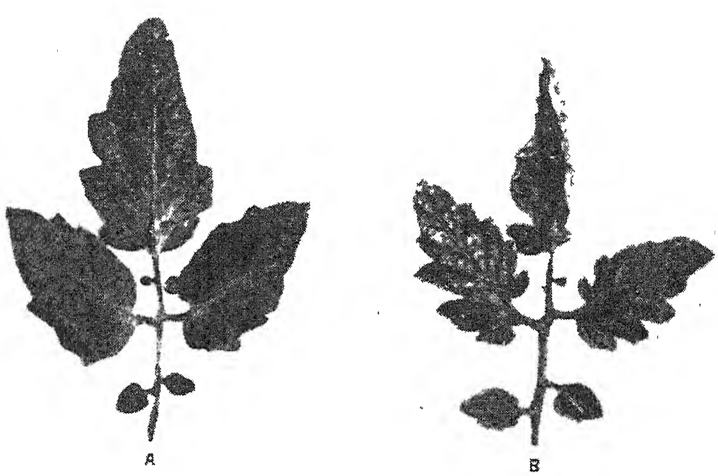
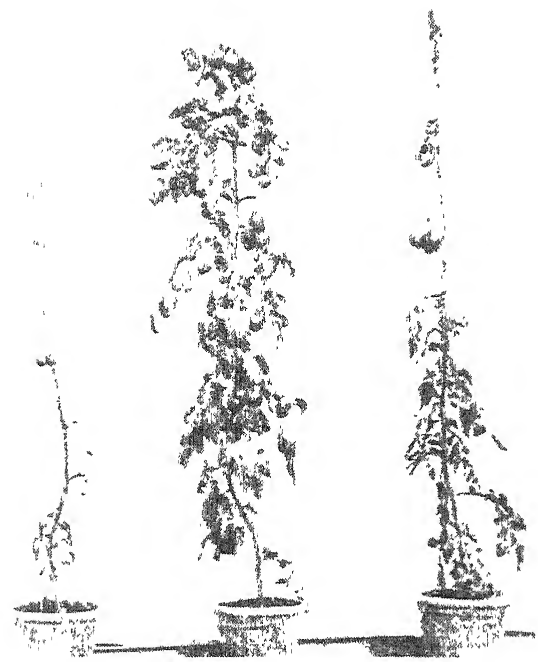


Fig. 2. Arrested development of potassium deficiency symptoms.
Right (B) Leaflet from lower portion of plant.

Left (A) Leaflet from central portion of same plant subsequent to light top dressing.

PLATE 2.



Effect of potassium on growth and development.
Left : No potassium. Centre : Light top-dressing only.
Right : Heavy basal dressing only.
(Photographed towards end of season).

Photos—I. C. McDonough.

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SOME OBSERVATIONS ON PARASITIC WORMS IN LIVESTOCK

By

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If a farmer were asked what disease amongst his livestock caused him the greatest financial loss, what would he say ? Would he say White Scour or Black Leg in his calves ? Mastitis, Sterility, Abortion or Tuberculosis in his adult cattle, or Braxy or Louping Ill in his sheep ? He is familiar with most of these diseases and has, no doubt, consulted his veterinary surgeon about them because their symptoms are spectacular and made a deep impression on him. But has he considered the loss due, not only to deaths, but to those "bad doers," to those young cattle and sheep which will not put on condition in spite of a good appetite and all that he does for them ; the loss due to delay in bringing young stock up to a saleable condition and even then fetching a poor price ; the loss from a reduced milk yield for no apparent reason, and the many other hidden losses ? All these losses can be caused by worm parasites, which include bowel worms, liver fluke and lung worms.

Many farmers may not agree with this statement, chiefly because they never see worms passed out in the manure, even after an animal has been suitably dosed. If the worms were all as large as some of those occurring in horses or in pigs, and were passed out in thousands, then such a spectacular evacuation would convince even the most hardened sceptic. But the most dangerous worms of young cattle and sheep are just like minute threads, many of which are not more than one third of an inch long, and which may be present in the manure in thousands without being seen with the unaided eye. If they are taken out of the manure and put into a clear fluid, as is done in the laboratory when making a *post mortem* examination, then they are readily seen and the sight is most convincing. It is these tiny worms which are referred to abroad as the "Bankrupt Worms" on account of the loss they incur to the farmer.

To estimate the financial loss due to parasitism in this country would, without making a detailed survey, be mainly guesswork. In the U.S.A. it is estimated, very conservatively, that the loss to livestock from worm parasites alone amounts to the equivalent of over thirty million pounds per year. On this basis, the loss in this country would be approximately one and a quarter million pounds per year ; it may even be higher, as we have small farms and small herds, conditions of farming which are more inclined to favour parasit-

ism. Especially is this the case during the present emergency when tillage is increased and grazing areas reduced.

This loss is preventible, or at least can be considerably reduced by simple and inexpensive means, provided it is gone about in the right way, but first it is necessary to know something about the habits of these worms before successful action can be taken against them. The aim of this article is to give an outline of the behaviour of the bowel worms, for these are by far the commonest and cause the greatest loss especially in young stock, in order to see from their behaviour what preventive measures can be adopted.

It is no exaggeration to state that all animals at pasture are carrying worms, some, the healthy ones, may have only a few thousand, for example a healthy sheep may carry three thousand worms, others, such as the " bad doers," may have many times that number. In ruminants, the tiny " Bankrupt Worms " live only in the fourth stomach and small intestine, they will not live anywhere else. Here they spend their time feeding on their host and laying enormous numbers of eggs which are so small that they can be seen only under a microscope. These eggs are passed out in the droppings and are spread over the pasture ; for example, they may be passed out by a healthy sheep at the rate of 200,000 to 400,000 per day, and by a diseased sheep at the rate of anything up to thirty million per day : in the case of a healthy cow, up to a million eggs per day may be produced. It is mass production with a vengeance ! If that pasture is grazed too long or by too many animals, the number of eggs will be astronomical. Therefore : —

Preventive Measure Number One is : " Do not overcrowd pastures."

In the course of a day or two from nearly all these eggs, a worm larva, microscopic in size, hatches out. But before this can occur there must be present three main conditions—a certain amount of moisture, some warmth and some oxygen. If these, or any one of them are not present, then hatching out is considerably delayed and the larva just waits in its egg until conditions become favourable. Extreme conditions of freezing or drying may kill the eggs, but in this country such conditions do not frequently occur.

After hatching out, the larvæ become very active. They proceed to grow and feed on bacteria and other substances which they get from the manure and which they store up in their bodies. During this growing and feeding phase they are not very resistant and may be killed by the action of direct sunlight, prolonged dryness or excessive heat ; in addition, they are not yet ready to assume a parasitic existence, for should they be swallowed by an animal they are killed by the action of digestive juices in the bowel. This pre-infective, free-living phase, however, is very short, lasting only a few days if conditions are favourable, but much longer, as with the eggs, if they are unfavourable. On account of this very short pre-infective period, it is

advisable to move young animals on to fresh pastures every few days, or, to quote an old Yorkshire saying, "Never let sheep hear the church bells twice on the same plot of land." This ensures that the young susceptible animals will have moved on before the worm larvæ enter their next and dangerous phase. Therefore :—

Preventive Measure Number Two is: "ROTATE STOCK, PUTTING THE YOUNG ANIMALS ON TO THE CLEANEST PASTURES."

A very great change now occurs; the larvae enter a resting stage, during which they stop growing and feeding, and develop into infective forms ready to assume a parasitic existence. They are still very active, but are enclosed in a tough outer jacket or sheath which completely shuts them off from the outer world and protects them from cold, from a certain amount of dryness and even from many chemicals, however, they are able to absorb oxygen, so very necessary for their existence, through this jacket. They are no longer free-feeding and have to subsist on the food material stored up during their pre-infective stages. Now their one ambition is to be swallowed by a suitable host, a young one for choice, so that they can assume a parasitic existence and grow to sexual maturity, but it must be the right species of animal. For example, if the larvæ from a sheep are swallowed by a horse or pig, they are immediately killed. This fact is of great importance and advantage can be taken of it, either by grazing different species of animals over the same pasture at frequent intervals, or by mixed grazing. Experiments have shown that a single horse grazing on a heavily infested sheep pasture can destroy from 50,000 to 100,000 parasitic sheep worm larvæ per day. Therefore :

Preventive Measure Number Three is: "EMPLOY MIXED GRAZING."

The aim now is to prevent these infective larvæ from entering their hosts in such numbers as will produce disease, for once they have entered suitable hosts it may be a case of losing a beast or having to look after a number of sick animals. It is essential, therefore, that as much as possible should be known about the habits of these larvæ if this aim is to be achieved. The important points to note are :—

Firstly—The larvæ are very small, not more than one-fiftieth of an inch long, hundreds could move about in a drop of water, so that it is impossible to see them on the ground.

Secondly—They are active and can climb up moist herbage, or even damp stable walls, their movements being controlled mainly by light and, to a lesser extent, by heat. A strong light, such as occurs during mid-day and afternoon, makes them retreat down to soil level but in a dull or diffuse light, for example, during moist cloudy weather or at dawn or dusk, they climb as far up the herbage as they can, for here they have a better opportunity of

acquiring a host. At night, they usually descend to soil level. This reaction to light explains why it is good practice to keep young stock housed at night, or, to use the well-known expression, "while the dew is on the grass." Therefore :—

Preventive Measure Number Four is : "KEEP YOUNG STOCK HOUSED OR IN THE FOLD WHILE THE DEW IS ON THE GRASS."

Thirdly—Infective larvæ are very resistant and can live for a long time. Their longevity mainly depends upon the conditions of their environment such as the type of soil and herbage, the amount of oxygen, moisture and warmth available and on their degree of activity. The more active they are the sooner they die, for once the food stored up in their bodies is exhausted they perish. On dry pastures the larvæ tend to penetrate into the upper layers of the soil in search of moisture, the ground forms a hard crust over them and, for want of oxygen and by the action of bacteria in the soil, they are killed. Under such conditions the larvæ die out in about two or three months. Wet, low lying or marshy lands, on the other hand, are ideal situations in which the larvæ will develop and live for long periods. They are ideal, not only for bowel worms, but even more so for liver fluke and lung worms, a fact which every farmer knows. Some bowel worm eggs and larvæ may live for fifteen months on moist grazing land, even longer if that land is broken up and aerated by the trampling feet of many animals ; on such land the larvæ develop best and live longest. Conditions such as these are frequently seen in sheep folds and paddocks situated near the farm yard, where young stock are put so that a better eye can be kept on them. This situation is often the wettest part of the farm and, as an added source of danger, is invariably near the manure heap. Therefore :—

Preventive Measure Number Five is : "IF PADDOCKS MUST BE KEPT NEAR THE FARM YARD, DO NOT OVERSTOCK THEM," and

Preventive Measure Number Six is : "AVOID WET PASTURES OR HAVE THEM DRAINED ; KEEP DITCHES CLEARED."

The final and most dangerous phase of the worm's existence is its parasitic phase. The infective larvæ enter their host with food or water which has been contaminated by being in contact with manure, droppings, etc., and, if the host is not strong enough to overcome this invasion, the larvæ establish themselves in their respective habitats, some in the fourth stomach and others in the small intestine where they develop into sexually mature worms. Then, in about three weeks or so, the females begin to produce their vast progeny which are passed out in the droppings, this mass production going on throughout the rest of their lives. The eggs must get out on to the ground for should they be retained in the bowel they are killed. Worms differ, therefore, from bacteria in that they do not multiply inside the animal's body and, in addition,

their progeny must have a free-living stage to prepare for a future parasitic existence. It follows, therefore, that an animal can only become infested with these worms by ingesting food or water contaminated with the larvæ. It may be mentioned here that there are other types of worms which can enter their host by penetrating the skin as well as by ingestion, but in this country they are not very important. Therefore :—

Preventive Measure Number Seven is : "WATER AND FEED FROM RAISED TROUGHS SURROUNDED BY GRAVELLED OR BARE AREAS WHEREVER POSSIBLE."

This, of course, applies mainly to animals in paddocks, in folds or houses, it is impracticable for those on pasture, but at least a clean water supply should be provided.

To give some indication of the number of worm larvæ which may be swallowed daily by grazing animals, here are a few interesting figures : A lightly infested pasture may carry from 30 to 40 larvæ per pound of herbage, a sheep on such a pasture, therefore, would ingest from 400 to 800 larvæ per day ; a milking cow on a similar pasture would ingest from 2,000 to 4,000 per day. On the other hand, a heavily infested pasture may carry over ten times that number, and from it a sheep may ingest from 4,000 to 8,000, or a dairy cow from 20,000 to 40,000 worm larvæ daily ; furthermore, if the herbage is short and the grazing poor, an animal must, unless extra rations are provided, graze closer to the ground and over a wider area if it is to get sufficient food, thus the intake of worm larvæ is considerably increased. The number of worms considered necessary to kill a young sheep are from 8,000 to 20,000, depending on the species of worm. On heavily infested pastures this number could be acquired very rapidly and would account for the sudden deaths, without any previous symptoms, which sometimes occur in young animals grazing over such pastures. These sudden deaths may be mistaken for a bacterial infection. Therefore :—

Preventive Measure Number Eight is : "MAINTAIN AN ADEQUATE NUTRITION."

It is reasonable to ask at this stage why all animals grazing at pasture and ingesting worm larvæ daily do not show symptoms of parasitic disease. The all-important factors in the production of disease are the extent of the infestation, the rate of intake and the condition of the animals at the time of entry of the larvæ. Parasitism is older than history, yet there are healthy livestock. No doubt, in earlier times animals lived a more natural life and were not the highly specialized creatures that they are to-day ; they lived in wide open spaces over which parasites were widely and thinly scattered, and the rate of intake was low and gradual, so that the relationship between host and parasite was well adjusted and friendly. To-day conditions are changed ; animals are highly bred, bred for speed, for appearance, for milk yield and for

texture and length of wool without any consideration for their resistance to disease ; also they are brought up in confined spaces, consequently they are more exposed to the invasion of vast numbers of parasites and the rate of intake is more rapid. To compete with these conditions the parasite produces excessive progeny, but the host can only respond by developing a resistance within its body which, under certain circumstances, is adequate to protect it against excessive parasitism. This resistance, however, develops slowly and may take five months or more to reach a sufficiently high level to afford protection.

When young animals after weaning begin to graze on pastures, provided these pastures are only lightly infested, they swallow small numbers of worm larvæ for the first time. In due course the larvæ grow into adult worms and begin to lay eggs, the presence of these worms in the bowel stimulates their hosts to produce a mild resistance. As the animals grow older and the worms in the bowel accumulate, passing out increasingly large numbers of eggs, the resistance develops at an equal rate, and a balance between host and parasite is maintained. Now, quite suddenly, the resistance develops to such a degree that the expulsion of a number of adult worms takes place, many of the invading larvæ are killed or expelled, and the worms permitted to remain are held in check so that fewer eggs are produced. If, however, such an animal's general state of health is lowered by malnutrition or by disease, this resistance level is not maintained, the worms then gain the ascendancy, and resistance against them is lost. It will be all the more evident that if young animals graze for the first time on heavily infested pastures, the rate of intake of larvæ is so great and so rapid that it exceeds the rate of development of resistance and disease must inevitably result.

Only animals that are well nourished and healthy will attain a high degree of resistance in the shortest possible time, that is, in about five months. If they are undernourished or suffering from disease, even though on lightly infested pastures, resistance may develop so slowly that during its production an imbalance occurs, the parasites become too numerous and disease again results. It has been shown that an extra ration of concentrates renders animals much less liable to attacks of parasites and, in certain circumstances, is sufficient in itself to prevent development of disease. Malnutrition, therefore, must be regarded as one of the important factors leading to worm disease in livestock. Therefore :—

Preventive Measure Number Nine is: "FEED YOUNG GROWING STOCK WELL."

From the observations so far made, three facts stand out clearly, *viz.*: (1) The chief source of worm parasitism comes from healthy animals which are carrying a large number of worms ; (2) That no indication of the presence of worms is given by these animals unless a microscopic examination of the

droppings is made to detect the worm eggs, and (3) That it is the young and undernourished animals which are most susceptible.

Disease may occur at any time of the year, as is commonly the case in calves, but in sheep it is most likely to appear during late summer and autumn, particularly in a dry autumn when the grazing is short and the worm larvæ are more rapidly picked up. The course of the disease is usually slow and protracted, but cases of sudden death may occur particularly after short periods of frost or drought, as well as under the conditions which have already been mentioned. During periods of frost and drought, worm eggs accumulate on the pastures, but the larvæ do not hatch out as conditions for their development are not sufficiently favourable. As soon as the frost or drought is over, conditions become favourable; the larvæ hatch out suddenly, to reach the infective stage in vast numbers at the same time. At this time and unless extra feeding has been allowed, animals will graze greedily at the sudden growth in the herbage and rapidly ingest large doses of infective larvæ. However, the most critical period in all ruminants is just at weaning, when the animals begin to graze. Therefore :—

Preventive Measure Number Ten is : " SEPARATE YOUNG STOCK FROM ADULTS AT WEANING AND PLACE THEM ON CLEAN PASTURES," or, if clean pastures are not available, " SUITABLE ANTHELMINTIC TREATMENT COMBINED, IF NECESSARY, WITH SUPPLEMENTARY FEEDING SHOULD BE GIVEN AT WEANING."

There are two other equally important and necessary preventive measures which should be employed in conjunction with those already mentioned. They are concerned chiefly with prevention by treatment and, briefly, are as follows :—First—Safeguarding against the further introduction of worm infestation by having all newly purchased animals examined and, if necessary, dosed before allowing them on to pasture. Second—Reducing the worm population carried by the healthy adult stock. This may be done by periodic treatment of all adult animals which will keep down to a minimum the number of eggs passed out on to the ground, and help to lower the larval population on the pastures.

In this connection it must be emphasised that treatment is of little avail without a correct diagnosis, this can only be made in the living animal by a microscopic examination of the droppings. Frequently owners mistake parasitic gastritis, caused by bowel worms, for fluke or liver rot and *vice versa.* In addition, there are other diseases which produce symptoms similar to those of worm disease, for example, chronic coccidiosis, certain deficiency diseases, etc. To ascertain what parasites are present is far from easy and can be done only by microscopic examination or by autopsy.

It may not be possible on some farms to carry out all the preventive measures here outlined, but even if only some of them are put into practice,

particularly those relating to the nutrition of young stock at the time of weaning, to the condition and situation of the paddocks and to the over-crowded pastures, and provided they are rigidly adhered to, there is no doubt that a considerable financial saving will be made by the farmer and a higher standard of healthier livestock will be attained.

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THE FEEDING AND MANAGEMENT OF POULTRY

Broadcast on Tuesday, 29th February, 1944, by DENIS PHILPOTT, B.Agr. Sc., M.Sc., Inspector, Department of Agriculture.

The ultimate object in commercial poultry keeping is the transformation of animal, vegetable and mineral matter, in forms not usually consumed by humans, into human food in the form of eggs and poultry meat. The transformation is brought about within the fowl's body and involves a number of different physiological processes, all of which depend on the proper functioning of numerous organs and tissues in the body of the live bird.

The primary function of the food consumed by a bird is the maintenance of life and health. The maintenance portion of the ration provides heat for keeping the body at normal temperature and energy for working the muscles involved in normal movements, and for the functioning of the various internal organs. Material for the renewal of tissues and for the elaboration of internal secretions must also be provided by the maintenance portion of the ration. The food provided in excess of that required for maintenance is used for growth by young birds. Growth entails the formation of muscle, bone, fat, and the tissues of internal organs. The food given to adults in excess of the amount required to keep them alive is utilised mainly for the manufacture and laying of eggs by laying fowls, and for the manufacture of poultry meat by table poultry. Maximum growth cannot take place in young stock nor can maximum egg or meat production be obtained from adult fowls unless ample food in excess of that required for maintenance is provided.

The rations of poultry must, of necessity, be rather concentrated for the digestive system of birds cannot deal with bulky foods. The poultry ration must supply proteins, carbohydrates, fats, minerals, vitamins and water for these are the materials required to sustain life, to promote growth and to manufacture eggs and poultry meat. An efficient and economical ration for growing, laying or fattening birds must not only supply these materials in sufficient quantity but also in the right proportions and in suitable form for the kind of stock for which the ration is designed.

The proper feeding of poultry is relatively more difficult and important than the feeding of larger livestock. Food is digested and utilised very rapidly by poultry and mistakes of any kind in feeding will produce immediate and serious ill-effects. With growing birds, improper or inadequate food results

in slow growth, retarded or abnormal development and in extreme cases, in death from malnutrition. Improper feeding also induces susceptibility to disease in both young and adult poultry. The effects of improper feeding of laying fowls are further reflected in reduced or low egg production. Eggs are composed of fixed and definite proportions of water, proteins and fats with small amounts of minerals and vitamins. The materials necessary to manufacture these substances in the egg can only come from the food consumed by the hen. A hen cannot manufacture and lay eggs unless the materials required for making them are supplied in the food, in sufficient quantity and in the proper proportions, in addition to the materials necessary to keep her alive and in good health. The number of eggs a hen lays is limited by the ingredient provided in restricted amount or unsuitable form in the food. Satisfactory egg production cannot be secured except the ration is properly balanced and fed in sufficient quantity. On many farms in this country the proteins supplied both to growing and laying poultry are insufficient in quantity. The feeding of unbalanced or inadequate rations is in practice mere waste of food. Birds getting such rations may live and remain healthy but cannot lay sufficient eggs to pay for the food consumed. A little extra food of the right kind would provide for the production of a greatly increased number of eggs and possibly ensure a profit instead of a loss.

The rations fed to growing, laying, and breeding poultry normally consist mainly of cereal grains or the by-products of these grains. These foods are the principal sources of carbohydrates and fat, substances necessary to provide heat and energy and to form fat in the bird's body and in the egg. The cereal portion of the rations of the kinds of poultry mentioned must be supplemented by small proportions of protein food usually of animal origin. Proteins supply the materials necessary for the formation of tissue and muscle to growing birds and for the manufature of the protein included in the egg to laying birds. In addition, certain minerals used mainly for the purpose of bone or egg shell formation and food factors known as vitamins which are essential for normal growth and health are necessary in the different rations. An adequate supply of clean fresh water is also necessary in the diets of growing, laying and breeding stock. The food of fattening poultry usually consists almost entirely of cereal meals with small additions of protein, preferably in the form of separated milk.

The carbohydrate portion of poultry rations can be supplied very efficiently by home grown cereals and potatoes. Oats, and barley as grain or meal are quite suitable for all kinds of poultry, while boiled potatoes fed in combination with these cereals are particularly useful for improving the physical and nutritional properties of the resulting mixture. The milling offals now available form a useful addition to the carbohydrate portion of poultry rations and can replace portion of the ground oats and barley in mashes.

The provision of suitable proteins for poultry feeding is no problem on the

majority of farms, for separated milk, skim milk or buttermilk are the most useful of all protein foods for poultry. Milk in either of the forms mentioned contains not only proteins of high quality but also vitamins and minerals that are of particular importance in the nutrition of young growing stock. Separated milk may be fed to all kinds of poultry in its liquid form instead of drinking water and may also be used in preparing wet mashes. On farms where separated milk is not available protein concentrates such as meat and bone meal, meat meal and fish meal must be used to supplement poultry rations. Ample range is a great asset for poultry as it provides protein in the form of insects, young grass and clover throughout the greater part of the year. The fullest use should, therefore, be made of pasture and especially of stubble over which poultry should be allowed to range.

A certain amount of mineral material mainly calcium, is required by laying fowls for the manufacture of eggshells. When such fowls have access to pasture and are given separated milk to drink they can procure their mineral requirements. Under more intensive conditions of management it may be necessary to supply lime in some form to laying fowls. Ground limestone, limestone grit or crushed eggshells are suitable sources of calcium. Where growing stock have access to grass runs and are given separated milk, the addition of supplementary minerals to the ration is unnecessary. Even under the most intensive methods of brooding and rearing the mineral requirements of growing stock can be satisfied by the addition to the ration of small quantities of finely-ground limestone and common salt.

Although a number of different vitamins are necessary for health and egg production in laying birds and for fertility in breeding stock the quantities required are very small, and the supply provided by such natural sources as green food, grain embryos, milk and direct sunlight is usually adequate. In practice, special provision for the supply of vitamins is unnecessary in the case of adult stock kept under natural conditions on free range. Even with chickens that are allowed on to fresh grass runs a couple of weeks after hatching, a serious deficiency of vitamins is unlikely to occur except possibly during severe weather in the early part of the year. Under conditions where available rearing ground has become contaminated with parasites and where no alternative to rearing in confinement exists, the chickens should be supplied with green food from uncontaminated land and provision for the entrance of direct sunlight to the brooder house should be made.

Detailed information regarding the feeding of poultry in existing circumstances is given in special leaflet No. 5., " Home Produced Foods for Poultry Feeding," copies of which may be obtained free of charge from the Department of Agriculture, Dublin.

The feeding of foods of only the highest quality to poultry is as important as the provision of properly balanced rations. Stale or musty food should

not be fed as it will cause serious digestive disorders both in young and adult stock. The food should always be fed in troughs or hoppers and these as well as water fountains should be kept scrupulously clean. Food should never be thrown on the ground to poultry. This practice is prevalent and should be discontinued as it is wasteful and liable to spread disease. Regularity in feeding is essential to secure the best results, and irregularity in the feeding routine can only lead to indifferent and unsatisfactory results.

Some weeks ago, in a broadcast talk, the Secretary of the Department of Agriculture stressed the promising prospects for poultry production existing at present and likely to continue for some years to come. He also pointed out the necessity for increased production of potatoes, oats, barley and wheat, so that the output of poultry products in the country could be increased in the present and subsequent years. Increased potato and cereal production during this and the next few years should be the primary concern of every poultry keeper and farmer. An increased volume of poultry and poultry products can only be produced if the raw materials in the form of potatoes, cereals and milling offals are available. Poultry keepers should also make provision immediately for the period of food scarcity that will occur during the months prior to the harvest this year. Any surplus oats, barley or potatoes available at present, should be stored under suitable conditions for use as poultry food during the late spring and summer months.

The principal factor in successful poultry keeping at any time, but particularly at present, is the quality of the stock kept. Maximum egg production and profit can be obtained only from pullets of the highest productive quality that are fed, housed and managed properly. It is waste of food to feed properly-balanced rations compiled from expensive foods to mongrel birds inherently incapable of producing large numbers of eggs. The amount of food required for maintenance by a poor laying hen is almost as great as that required by a good laying hen of the same body weight. Of the total ration consumed by a hen producing one egg every two days, about 57 per cent. goes for maintenance and about 43 per cent. to the production of eggs. The proportion required for maintenance is much greater in the case of a bird producing fewer eggs. The eggs produced must pay for the portion of the ration used for maintenance as well as for the part used for the production of eggs, so that the greater the number of eggs produced, the smaller will be the proportion of the price of each egg required to meet the cost of the food consumed. Thus a hen of 5 lbs. weight producing 100 eggs per year consumes a total of about $9\frac{1}{2}$ lbs. of food for every dozen eggs produced, while a hen of the same weight producing 200 eggs per year consumes only about $5\frac{1}{2}$ lbs. of food for every dozen eggs produced. The cost of food represents over 60 per cent. of the cost of production of commercial eggs so that the higher the egg production the lower will be the cost of producing each dozen eggs.

The good layer also lays large numbers of eggs during autumn and winter when the price of eggs is high. It will be obvious, therefore, that the best laying birds give the highest profit.

Good birds, properly fed, must also be provided with suitable houses and range, if they are to lay the maximum number of eggs of which they are capable. Poultry laying houses must be solidly constructed, must be dry, and provide ample floor and perch space, sufficient light and ventilation free from draughts and should at all times be kept in a clean and sanitary condition. The laying house should be located so that the birds in it have access to extensive clean range. Hens running over a dirty farmyard, drinking from stagnant pools, and picking on manure heaps cannot be expected to remain healthy and to lay large numbers of eggs ; and it is impossible to produce clean eggs under such conditions.

Chickens and growing stock must also be provided with comfortable conditions if they are to make satisfactory growth. Brooding and rearing houses must be well constructed, provide adequate floor space, ample lighting and ventilation. They must be kept scrupulously clean and in sanitary condition at all times. Indoor or intensive methods of brooding that might be feasible in normal times cannot be recommended in existing circumstances as it may not be possible to provide the complete rations required by chickens kept under such conditions. Outdoor methods of brooding, rearing and management should, therefore, be employed to the greatest possible extent. It is essential that chickens and growing stock should have access only to fresh ground and young stock should never be allowed on to ground on which adult poultry are kept. The brooding and rearing ground should be entirely apart and no poultry other than growing stock should ever be allowed on to it. Turkeys and domestic fowls, either young or adult, should also be kept apart as the health and progress of both will be impaired when run together.

The proper feeding and management of poultry are not difficult, provided care and foresight are exercised. It will pay the poultry keeper well to devote the necessary care and attention to the feeding and management of the birds. The work involved in keeping poultry is not laborious, but it must be carried out regularly and methodically. The poultry keeper who does the work thoroughly, will find it interesting and remunerative.

THE BUILDING UP AND MAINTENANCE OF HEALTHY STOCKS OF SEED POTATOES

A REVIEW OF THE WORK

By D. Delaney, B.Sc., A.R.C.Sc.I., and P. Keenan, Supervising Officer (Seed Potatoes).

The oldest available records regarding the cultivation of the potato show that it has almost universally been considered necessary to change periodically the original stocks of the farm, or district. In many parts, indeed, " a change of seed " was regarded as the panacea for all potato ills.

This widespread belief in the efficacy of a change of seed, may be attributed largely to the actual experience of generations of growers, who observed a falling-off in the vigour, purity and productiveness of stocks kept too long on the farm, and to the improvement that resulted in most cases from the introduction of fresh stock. There would naturally be exceptions now and again to this general experience of benefit accruing from a change, which cannot be wondered at, considering the methods employed and the limited knowledge available of the causes underlying the degeneration of potato stocks. Yet, the grower of those days was not entirely without guidance (when looking for a change of seed) and was not trusting to blind chance alone. It might be little more than a sort of tradition, or a generally accepted belief that to get good results the new stock should come from a certain kind of soil—from some colder climate, or a locality looked upon as suitable for seed production. Thus in this country, as in Great Britain and elsewhere, bog soils were usually regarded as the best for this purpose. Again, seed grown on a mountain side, or in some exposed locality, would be much in favour. On the other hand, it was not considered good husbandry to reverse the procedure, by bringing seed from warm sandy soils by the sea-shore to plant in the colder uplands.

For a long time no satisfactory explanation could be offered even by leading agriculturists, as to why seed from some localities gave better results than that from others, or again why it was that even the best seed deteriorated rapidly in certain districts and remained healthy so much longer elsewhere ; for few could fail to observe how a vigorous variety such as British Queen degenerated quickly all along the East coast yet retained its vitality for many years in the moist bog-soils of the Midlands, and it was believed by many that the cause was to be found in the different character of the respective

soils. It is probable, however, that the great majority of growers troubled themselves very little about the matter, and hardly thought of attributing the decline to any definite disease. They took it that the variety was dying out sooner in their own district than in some others, but that with a bit of luck it might be renewed from time to time by seed from those more favoured areas, where it was still growing vigorously.

And so the position remained through the years, almost as it was when the potato was first introduced, for under the old system—or rather, want of system, which obtained all over the country—no co-ordinated progress could be made in the production of reliable seed. A farmer might, indeed, with much expense and trouble, procure a new stock from some remote district, but he had no guarantee that it was even slightly better than his own rejected stock. Worse still, in many cases the grower did not even obtain the variety he had ordered. Indeed the difficulty of obtaining seed true to variety and not "mixed" constituted a major problem for growers.

It is a noteworthy fact that this country was among the first to have the question of health as affecting seed potatoes examined from the scientific point of view, and it was under the auspices of the Department of Agriculture about 25 years ago, and later in co-operation with the University Authorities at Albert College, Glasnevin, Dublin, that some of the earliest research work was carried out, with the late Dr. Paul A. Murphy as one of the pioneers. New light was thrown on the whole subject of potato degeneration, and as a result of much painstaking research work, it was clearly demonstrated that what is known as the virus family of diseases was largely, if not wholly, responsible for the deterioration and loss of vitality in stocks, with the consequent reduction in yields. "Leaf-roll" one of the most serious diseases affecting the potato crop, was shown to be due to infection with a virus of this nature, as was also the group of diseases known by the term "Mosaic." This was a discovery of the greatest importance, as was also that of the transmission of viruses, partially at least, by sucking insects of the green-fly species—especially *Myzus persicæ*. When it was realised what a bearing these discoveries had on the whole question of healthy stocks of seed, every effort was made to turn the knowledge thus gained to the best account, by making it available to seed-growers at large. The machinery by which this was to be effected had not as yet been evolved, but it was soon to be on the way.

Whether other factors might enter into the question of degeneration was beside the point, for the presence of one or more of these viruses would often of itself necessitate a complete change of seed; for we can well imagine how a grower would appreciate the change from a crop badly affected with say, "Leaf Roll," to one free from the scourge, even though he knew neither the name of the disease, nor its cause. The effects were, in themselves, striking enough.

So when, a little over two decades ago, the Department of Agriculture appointed the late Dr. W. D. Davidson to supervise the work of inspection and certification of growing crops, a new era began for the potato-growers of this country. From the outset no pains were spared to have crops that were intended for seed purposes pure, and true to name. Whole-time officers were appointed to inspect the growing crops, and thus ensure that they were up to a certain standard of purity and health before issuing a certificate that the produce was suitable for seed. Later, when the same produce was being marketed a seal was affixed to every sack of seed that reached the required standard.

Considering the mixed condition of all varieties at the time, even in the so-called "seed districts" the work of affecting a thorough "clean up" naturally took up most of the time of the officers employed, who in the early stages of the work often had to spend days helping to dig out the "rogues" from some crops, so that little could be done in the matter of health. But even in the early years of inspection serious thought was given to the question of health in stocks, and it was dealt with in the definite conditions laid down for certification, one of which was that under no circumstances could a certificate be given to a crop showing any sign of Leaf Roll.

This condition, strictly enforced, soon confined the growing of seed—at least of certified seed—to the districts best suited to its production. Few growers could hope to attain the required standard in a district or county where Leaf Roll was prevalent. Similar conditions, if not quite so drastic, applied to the "Mosaic" group of diseases.

Even this negative way of dealing with the problem gave, after a time, good results. The ordinary commercial stocks showed great improvement. In the first place, they were of a high standard of purity, were practically free from Leaf Roll, and comparatively free from severe mosaic. In a few years the demand for certified seed was doubled and trebled in the home market, and was in increasing demand in Cross-channel and foreign markets when the present world-war broke out.

A new system was now adopted for the further improvement of seed which put the work of building up and maintaining healthy stocks on a firmer basis. Hitherto, methods of mass selection were relied upon and it was sought to produce better stocks by a process of elimination—by a continual weeding out and rejection of inferior plants, or crops, and propagation of the better stocks only. The new method employed, which supplemented rather than supplanted the old one (for this was still retained in full force for commercial stocks) was to select a few of the best plants called units) from a plot as free as possible from all trace of virus disease. By arrangement with the Agricultural Faculty of University College, Dublin, the tubers from these units are then thoroughly tested by the latest scientific methods at the laboratories

of the Plant Pathology Department, Albert College, Glasnevin. The produce of all units proved to be free from virus is used as the nucleus from which it is proposed to build up completely healthy stocks. This building-up can only be done in a district offering special facilities for the purpose.

Before describing in detail the further development of the units thus tested, and the district selected for the work, it may be of interest to refer here to the manner of spread of virus diseases, at least of the most virulent, for this bears a direct relation to the means employed in the production of healthy stocks—it is, in fact, the key to the work.

As already stated, it has been shown that certain viruses are responsible for the break-down in potato stocks, and also that some at least of these viruses are transmitted by sucking insects when feeding on the growing plants, the Aphis, *Myzus persicæ*, being the chief agent in this destructive work. To it is undoubtedly due the transmission of the Leaf Roll virus, of Virus-Y (Leaf-drop Streak) and of Virus A (one of the constituents of Crinkle).

It follows then that in any locality where this species can, for any reason, thrive and multiply, the health of the potato crop will suffer in proportion, and inversely, good crops can only be produced, and healthy stocks maintained where the pest is of rare occurrence. Loughnane (*Journal*, Vol. XXXVII, No 2.) has shown that while in certain districts in County Dublin the Aphis, *Myzus persicæ*, occurs in fairly large numbers, especially in early summer, the number found in the seed producing districts of the North-West is practically negligible. The weather is a great determining factor. Indeed, when put in terms of climate, it has long been recognised that the most suitable environment for the maintenance of healthy stocks is a bleak, cold, and wind-swept region, with a continuous rainfall—especially in summer. Such an environment is found to perfection in Co. Donegal. For many years the ordinary stocks in that County have shown a high standard of health and vigour, a standard that was always easy to maintain, even though potatoes were grown most intensively all over the county. For these reasons it was decided that here should be built up the future healthy stocks of the country.

In other words, the measures to be taken were preventative, and not remedial with the climate and soil as the chief agents in the work of prevention. And these supplied a fairly effective means of combating not only Leaf Roll, but also to a great extent as has already been shown, the development and spread of several forms of Mosaic disease. The origin and transmission of this group of viruses were more obscure and difficult to trace. They are found wherever the potato is cultivated but in varying degrees, and in various forms, now in a simple one, as in Virus-X, again in the form of Crinkle (a combination of X + A) etc.

In the case of simple Mosaic (Virus X) climatic conditions do not appear to exercise a paramount influence, as in Leaf Roll and Virus-Y, nor even extremes of elevation, for experience has shown that Virus X exists and will spread in certain areas at heights of over 5,000 feet, above sea level. By itself, however, (apart from its combinations) it will not cause deterioration of stocks to a very serious extent. But it is a very different case with the deadly Virus-Y, and also Virus A (one of the constituents of Crinkle). Here the same greenfly that is responsible for the spread of Leaf Roll can pick up and transmit these two viruses as well. Bearing this point in mind, the question of climate and habitat assume a new significance, and the reputation for health that seed from certain districts has long enjoyed can be accounted for to a large degree.

Another means of transmission of mosaic viruses, and perhaps the most potent, is that of contact. An unhealthy plant can communicate the infection to healthy plants around it (but only when actually touching them), and as the virus passes on to the tubers in due course, the number of infected plants may become multiplied many times in the next season.

This transmission, however, can be prevented by the simple method of having a neutral or " buffer " zone to separate healthy from ordinary stock, but this is not quite effective in the case of aphid borne viruses. Practical considerations limit the degree of safety which may be provided in this way but in the building up of the Department's foundation stocks, every effort has been directed towards propagating them on sites as far removed as possible from farm crops which may carry virus diseases. Once a plant or stock becomes infected, no cure exists, and thus every effort must be concentrated on preventing spread of the disease.

And so, in the selection of the ground for the healthy units or " nucleus stocks," good isolation has been regarded as the first essential—isolation of two dimensions, space and time. For while isolation in itself is by no means an infallible guarantee of immunity from infection, it is unquestionably a great safeguard, as apart from the " contact-spread " of Virus X mentioned above, it has been shown that the insect vectors of other viruses have a limited range of activity. Not only, therefore, has every effort been made to have the " nucleus stocks " planted as far away as possible from other potato crops, even where these crops are healthy, but so far as possible fields have been selected which had been in grass for a period of years. The reason for this is that miles of isolation from other crops would be of small avail if " ground keepers " were suddenly to appear from a potato crop grown in the same ground two or three years previously.

The units are planted among a crop of turnips, the tubers of each variety in a plot by themselves. Each plot is separated by 7 or 8 yards of turnips from its nearest neighbour in the same drills, and by anything from 20 to

40 drills from the adjacent plot across ; several rows of plots generally occur in the same field.

All the later-day varieties are represented, but not all those in common cultivation. For instance the well-known varieties, Up-to-Date, King Edward and Golden Wonder are absent, the reason being that in the case of the two latter a virus-free plant of either has never so far been found, and indeed, can hardly now exist. The variety King Edward, even where no disease is visible to the naked eye, is known to carry a virus disease named "Para-crinkle"—perhaps not transmissible under normal field conditions and Golden Wonder is always found to be infected with one or more strains of Mosaic—especially Virus A. Most stocks of Up-to-Date carry a latent Virus X with Virus B also widespread. (Improved stocks of this variety, however, along with several others are grown in isolation through the country, and certainly show up to much advantage, when contrasted with ordinary commercial stocks of an older and unimproved type). On the other hand, a few healthy units of the old popular Champion have been found, their vigour unimpaired by the passage of over half-a-century. From these, a stock free of all virus was built up and a representative plot of it appears here with the rest.

Most of the varieties that came to the front during the past 20 years are represented—Kerr's Pink, Arran Victory, Arran Banner, Arran Pilot, Arran Peak, Gladstone, Dunbar Rover, etc., with others of an earlier date—Epicure, British Queen, Majestic, Great Scot. Immunes, naturally, hold the chief place, but the non-immunes, where still in popular demand, are by no means neglected.

During the growing period, and especially in early summer, these plots are inspected frequently to make sure that every plant is free from all trace of virus disease. Weak and undesirable plants, such as those showing a tendency towards "bolting," are at once removed. In some cases to improve the stock further, special selections are made from plants with a better type of foliage.

When the few original tubers have been increased by propagation to one or two cwts. they are planted out under similar conditions of isolation, etc., with a grower who has long experience in the raising of certified stocks.

Sometimes, however, where important varieties are involved, of which no similar stocks have previously been distributed over the country, they are retained for a year extra in the plots, for the purpose of better and more frequent inspection. A larger quantity will then be available for distribution this time in several lots, for care must be taken against the risk of accident or breakdown. This might involve the complete loss of the stock and a set-back for some years.

Gradually the increase goes on from year to year, first, from the few laboratory-tested units released from the Plant Pathology Department, Albert College, Glasnevin, then on through the "nucleus stocks" to the larger plots planted out in the district, one, two, three years removed, all developing in like proportion. The growers selected co-operate well in the work, of providing all the facilities required in the growing of the crop. It will be observed too that in this work there is close co-operation between the Department of Agriculture and the Plant Pathologists at Albert College. Isolation of 100 yards from all other potatoes is insisted on. A field out on lea for a number of years is sought for, as apart from the question of "groundkeepers" a good rotation is of the utmost importance to the general health of the crop.

The crops thus grown are named "Foundation Stocks," and their produce, where finally certified as such, is intended, not for export, nor even for indiscriminate distribution locally, but for location in the seed-producing districts under the various Co. Committee Special Schemes, and the distribution is supervised by the inspectors of the Department. The produce of this foundation stock is termed "HEALTH Stock" and the succeeding crop constitutes the certified seed for widespread distribution.

During the growing period these Foundation Stocks are inspected closely at regular intervals, and especially early in the summer. It often happens that virus diseases, if present, can be detected more easily when the foliage is young and tender (though this is not invariably the case, as much depends on the season, and on weather conditions).

But there is a stronger reason why early inspection is desirable, and that is to get an infected, or suspected plant, removed at an early stage, to reduce the risk of virus spread by contagion. And when, as occasionally happens, a plant appears showing even very slight signs of mosaic disease, and where, a few years ago, it would have been considered sufficient to remove the infected plant, it is now essential that every adjacent plant likely to come in contact with it be dug out as well.

It is impossible to indicate the source of a first infection in a stock. It may be a lone aphis-borne one, as probably happens when a single plant affected with Leaf Roll is found in an otherwise quite healthy stock, or it may arise from a small tuber dropped by crows, but it does occasionally arise. Where such is noticed, and the offending plant removed at once, along with all adjoining ones, the stock could remain healthy for a long period. This applies particularly to the sudden appearance of a plant infected with Y-Virus, in say a large field of Arran Banner. When taken out in above manner at an early stage the disease might not re-appear in the same stock for years.

As regards relative degrees of health in stocks of the different varieties there is still a certain amount of variation to be found. No two varieties re-act in the same way to the spread of infection, even if all the other factors isolation, environment, cultivation, etc., were equal as regards parent stocks. It must not be assumed, however, that given a few healthy units to begin with, and careful attention afterwards, it is a simple matter, in fact, only a question of time, to build up scores of acres of any variety with a perfectly uniform standard of health, and that every ton of Foundation Stock Seed sent out naturally conforms to this standard. It is a simple task to examine thoroughly every plant in a nucleus plot, even in the second or third year, but when this plot has grown to, say an acre in extent, and there are also to be examined many more such acres, each with its 20,000 plants or thereabouts, it is physically impossible to examine each plant with the same minute attention to detail as in the initial stages. Indeed, there is not the same necessity for such minute examination, as an infection introduced at this stage would cause much less injury to the after life of the stock than if introduced in the first year or two of propagation. It is claimed, however, that the Foundation Stock Seed so built up is of the highest standard attainable under field conditions—100 per cent. pure, free from all visible symptoms of severe mosaic, leaf roll, and other crop reducing diseases. It is, therefore, far ahead of ordinary commercial stocks and provides excellent material for building up and maintaining healthy stocks of seed potatoes for distribution throughout the country.

A quantity of healthy seed of each of the more important varieties, sufficient to meet the demands from the Committees of Agriculture for replacement stocks, both for the export seed trade and the home market is available annually.

Arran Pilot has been built up at a rapid rate, and the new stocks are very satisfactory. With the constant renewal from Health Stocks, Virus-Y and Simple Mosaic are rare even in good commercial stocks, though a few years ago the case was different.

Arran Banner Health Stock is now spread all over the country, especially in the seed districts, and the standard is undoubtedly high. This applies even to stocks of this seed, grown for one and two years, in counties where infection is widespread.

Kerr's Pink had varying fortunes, and until lately it was found very difficult to build up an all-round good stock, without Simple Mosaic, sooner or later, making its appearance. More success has attended recent efforts, until in the season of 1943, a stock of a score of acres had been developed, where as far as could be observed, no plant affected with even Simple Mosaic (Virus X) was present. This is satisfactory, though it can hardly be hoped that this standard can be maintained on a wide scale. Apart from this

satisfactory stock, a smaller nucleus stock is entering its third year, and this has been even more thoroughly tested than any foregoing lot.

Other varieties, perhaps of less importance at present, but worthy of a place, are being built up in like manner. An example is the old variety "Arran Victory"— with one serious drawback, its bright blue colour—a variety unequalled for cropping capacity, of fine cooking qualities, and an unrivalled keeper. Such hardy varieties are, not being lost sight of and an excellent but limited quantity of Foundation Stock Seed is now available for distribution.

In the light of experience and while the present system of inspection and certification of potato crops for seed purposes remains in force, it is most unlikely that useful varieties will in future quickly deteriorate or that yields will suffer serious reductions through virus diseases, if the opportunity of securing a change of healthy seed at regular intervals is availed of.

The following are particulars of the conditions of certification of crops grown in approved districts for the production of certified seed.

1. The crop must be pure and true to name. A certificate cannot be granted if the crop contains any mixture of varieties.

2. The crop must be vigorous and carefully cultivated.

3. The crop itself, and all other potatoes grown in the same field, must be free from Leaf Roll, and from any form of Streak Disease.

4. The crop must be free from plants affected with Mosaic Disease where it is obvious that the disease is causing a reduction in their yielding capacity.

5. All plants affected with Black Leg must be dug out before certification.

6. Rogues must be dug out, *not pulled.* Where the Inspector finds that a rogue plant has been pulled and the tubers left in the ground, a certificate will not be granted.

7. A crop in which "ground keepers" appear will not be certified.

8. Crops will not be certified if potatoes are grown more often than once in four years on the same land. This condition will be rigidly enforced.

9. Crops will not be inspected where more than four varieties are grown on the same farm. In all cases where more than one variety is grown, the varieties planted must be from different groups, as given below.

If two or more varieties from the same group are planted a certificate will not be granted.

GROUPS :

(*a*) Di Vernon, Catriona.
(*b*) Early Rose, Beauty of Hebron.
(*c*) Doon Early, Epicure, Arran Crest.
(*d*) May Queen, Sharpe's Express, Eclipse, Ninety-fold, Arran Pilot, Royal Kidney.
(*e*) Duke of York.
(*f*) Great Scot, Arran Banner.
(*g*) Up-to-date, Field Marshal, President, Arran Cairn, Dunbar Standard, Arran Peak.
(*h*) Majestic, British Queen, Abundance, Puritan, Dunbar Rover, Doon Star.
(*i*) King Edward, Gladstone, Doon Castle, Doon Well, Doon Eire, Dunbar Cavalier.
(*j*) Arran Victory, Edzell Blue, Garden-filler, Black Skerry.
(*k*) Golden Wonder, Langworthy.
(*l*) Champion, Invincible.
(*m*) Kerr's Pink, Irish Queen, Red Skin.
(n) Arran Consul.

10. Where two or more varieties are grown in the same field a division of not less than 9 feet in width, in which any crop other than potatoes may be planted, must be left between the varieties. Where, however, the crop is cultivated and raised by spade labour, a space of 2½ feet between two varieties will suffice. The Department regards observance of this precaution as absolutely necessary to ensure that varieties will not become mixed when the crop is being raised.

11. Health Stock Seed will be certified as such *only* on farms where commercial stock of the same variety is not grown.

12. Health Stock Seed must be grown on new land only.

13. Crops which contain more than 10 per cent. blanks will not be certified. Planting whole tubers minimises blanks.

In future, certificates issued in respect of inspected crops will be of three grades, "SS," "A" and "H" certificates.

The "SS" certificate is reserved for crops of the highest standard of health and purity, the produce of which provides the Foundation and Health Stock Seed. Such crops as already descibed are built up from laboratory-

tested units and are the subject of special supervision and management throughout the different stages of development.

They are pratically 100 per cent. pure,
Free from visible symptoms of Leaf Roll, Mosaic or other crop-reducing viruses and from which Black-Leg and Bolter plants, if present, have been removed prior to certification.
Grown in good isolation.

The "A" certificate will be issued in respect of the higher grades of ordinary commercial crops which are 99.95 per cent. pure, do not contain more than 1 per cent. virus diseases, free from visible symptoms of Severe Mosaic and Leaf Roll, and suitably isolated from unhealthy potato crops. Bolter and Black Leg Plants removed prior to certification. The " H " certificate crops must be 99.5 per cent. pure, contain not more than 2 per cent. virus diseases and be practically free from Severe Mosaic and Leaf Roll.

(Received for publication on 20th March, 1944).

REPORT OF THE SEED PROPAGATION DIVISION, 1943.

As in previous years the bulk of the barley propagations and other investigatory work was carried out at the Cereal Station, Ballinacurra, Co. Cork, in close collaboration with Messrs. A. Guinness, Son & Co., Ltd., at whose Experimental Maltings the malting tests were conducted. The work consisted of the usual pure line propagations, large-scale variety, half-drill strip and other experiments.

Pure line propagations of Red Marvel Wheat and Black Tartary Oats were maintained at the Cereal Station and extension plots of Red Marvel Wheat, Victory II, and Ardri Oats were grown in the neighbourhood of Ballinacurra.

BARLEY.

The method adopted in 1929 in the selection of Spratt-Archer 37 No. 3 was again adopted in the selection of Spratt-Archer 37 No. 3 and Spratt-Archer 37 No. 4. This method consists of sowing five grains from every fifth plant of a single line in the preceding year. The pure line is thus composed of twenty-five five-grain lines. Each of the other varieties was propagated by taking the requisite amount of seed from the single line grown in 1941.

In addition to the pure lines mentioned above, forty-two single plant selections were grown in the New Cage at the Cereal Station, Ballinacurra. These were as follows :—

Spratt-Archer 37/6, Spratt-Archer 37/6 No. 7, Spratt-Archer 37 No. 4 (five grains from each of twenty-five plants), Archer Goldthorpe 4/5/1, Spratt-Archer Goldthorpe, Old Irish, Burton Malting, Victory, D.S.K. Binder, Plumage Archer, Duck Bill, Hybrid No. 1C, Hybrid No. 4A, Hybrid No. 4 B.1, Hybrid No. 7, Black Himalayan, Kenia, Neils Franchen, Naked Barley, Golden Archer 1, Golden Archer 2, Goldberg, Spratt-Archer 37 No. 3 x Victory 1, Spratt-Archer 37 No. 3 x Victory 2, Glabron, Pearl, Donegal six-rowed, July six-rowed, Beavens F. 112, Beavens 49/14/3, B.244, Spratt-Archer 37/9 x Golden Archer 2 No. 1, Spratt-Archer 37/9 x Golden Archer 2 No. 2, Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{1}$, Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{2}$, Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 1, Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1. No. 2, Maja, Beaven's 54/12/3. Also the F.1 generation of the following new crosses: Spratt-Archer 37 No. 3 x Kenia, Spratt-Archer 37 No. 3 x Spratt, Spratt-Archer 37 No. 3 x Archer.

Garden Field and First Pedigree plots as follows were grown on the farm of John H. Bennett, Ltd., Ballinacurra :—

GARDEN PLOTS.

A number of plots of the variety Spratt-Archer 37 No. 3 for experimental purposes, also :—

Spratt-Archer 37 No. 3 (25 lines).
Spratt-Archer 37 No. 3 Selection No. 7.
D.S.K. Binder.
Golden Archer 2.
Spratt-Archer 37 No. 3 x Victory 1.
Spratt-Archer 37 No. 3 x Victory 2.
July six-rowed.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{1}$.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{2}$.
Spratt Archer 37 No. 3 H.9 x Golden Archer 2 No. 2.
Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 1.
Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 2.
Spratt-Archer 37/9 x Golden Archer 2 No. 1.
Spratt-Archer 37/9 x Golden Archer 2 No. 2.
Beaven's 54/13/3.
Spratt x Archer F.2.

FIELD PLOTS.

Spratt-Archer 37 No. 3.
D.S.K. Binder.
K.Spratt-Archer 37 No. 3 x Victory 2.
Beaven's 54/12/3.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{1}$.
,, ,, x ,, ,, $\frac{1}{2}$.
,, ,, x ,, ,, 2.
,, ,, x Hybrid 4 B.1 No. 1.
,, ,, x ,, ,, ,, 2.
Spratt-Archer 37/9 x Golden Archer 2 No. 1.
,, ,, x ,, ,, 2 ,, 2.

FIRST PEDIGREE PLOTS.

Spratt-Archer 37 No. 3 (4 acres).
D.S.K. Binder ($\frac{1}{2}$ acre).
July Six-Rowed (1 acre).
Spratt-Archer 37/9 x Golden Archer 2 No. 1 (1 acre)
,, ,, x ,, ,, 2 ,, ,,
,, 37 No. 3 H.9 x Hybrid 4 B.1 No. 2 (1 acre).

The produce of these plots will be available in 1944 for further propagation and Large Scale Variety Experiments.

Second Pedigree plots of Spratt-Archer 37 No. 3 were grown under contract with the following farmers in the neighbourhood of Ballinacurra :—

	Brls.	*Sts.*
M. Kelleher, Geragh, Ballinacurra	6	12
P. McCarthy, Castleredmond, Ballinacurra	4	–
R. Barry, Broomfield, Midleton	7	8
J. O'Reilly, Ballinabointra, Carrigtwohill	4	–
D. Leahy, Whiterock, Midleton	7	–
TOTAL ..	29	4

The produce of these plots will be available for distribution as nucleus stocks of pedigree seed in the spring of 1944.

For a number of years the Department has had in operation a scheme under which nucleus stocks of Pedigree Spratt-Archer barley are distributed each year to members of the Irish Maltsters' Association and others interested in seed barley distribution. Those who obtain such stocks undertake to have them grown with reliable farmers; to buy the produce if suitable for seed purposes, and distribute it to growers in the following season. Under this Scheme 444 barrels of Spratt-Archer 37 No. 3 were distributed to the following :—

	Barrels
Messrs. Minch, Norton & Co., Ltd., Athy	55
,, ,, ,, ,, Nenagh	23
,, ,, ,, ,, Bagenalstown	20
,, ,, ,, ,, Barracore	15
,, ,, ,, ,, Stradbally	20
,, Beamish & Crawford, Cork	5
,, N. Hardy & Co., Ltd., 72 Park Street, Dundalk ..	10
,, P. O'Meara & Sons, Ltd., Thurles	15
,, Cairnes, Ltd., Drogheda	10
,, J. Bolger & Co., Ltd., Ferns	10
,, Birr Maltings, Ltd., Birr	10
,, F. A. Waller & Co., Ltd., Banagher	15
,, Geo Read & Co., Ltd., Roscrea	15
,, Joshua Watson & Co., Ltd., Carlow	30
,, ,, ,, ,, Leighlinbridge	15
,, W. J. O'Keefe & Son, Wexford	10
,, D. E. Williams Ltd., Tullamore	65

		Barrels
Messrs.	P. & H. Egan, Ltd., Tullamore	22
,,	J. & A. Tarelton, Ltd., Tullamore	10
,,	R. Gibney & Co., Ltd., Portlaoighise	10
,,	A. J. M. Reeves, Esq., Athgarvan Maltings, Co. Kildare	4
Messrs.	North Tipperary Maltings, Ltd., Nenagh	25
,,	Latchford & Sons, Ltd., Tralee	10
,,	P. J. Roche & Sons, Enniscorthy	10
,,	R. Perry & Sons, Rathdowney	10
	TOTAL ..	111

In addition to the above, the following quantities of seed barley were also distributed :—

	Brls.	Sts.
D.S.K. BINDER.		
To the Agricultural School, Athenry, Co. Galway ..	7	8
JULY SIX-ROWED.		
To the Agricultural School, Athenry, Co. Galway ..	10	1

INSPECTION OF GROWING CROPS FOR SEED PURPOSES.

In order that those who co-operate in the Scheme for the Distribution of Pedigree Spratt-Archer seed might have information regarding the suitability of the produce for seed purposes, the Department arranged to have the crops which were grown for this purpose inspected by the Agricultural Instructors before harvest. For inspection purposes the crops were divided into three classes: (1) Crops grown from seed obtained from Ballinacurra in 1943; (2) Crops grown from seed which was the produce of seed obtained from Ballinacurra in 1942 and (3) Crops grown from Commercial seed of Spratt-Archer 37 No. 3. As regards (3) inspections were only made in those cases where the maltsters concerned were of opinion that they would not have sufficient seed otherwise and so required inspections made of the most promising crops grown from Commercial stocks.

A total of 6,917 statute acres was inspected, of which 5,615¾ acres were reported as likely to produce grain suitable for seed purposes if properly harvested. Of the 661 acres inspected under category (1) 23½ acres or 3.5 per cent. were rejected because of smut or an undue admixture of wheat, oats and other barley.

In category (2) 4,128½ acres were inspected and 921¾ acres, or 22.3 per cent., were rejected. The rejections were chiefly due to other barleys having been sown in the same field, poor crops, smut and the presence of an undue amount

of oats and wheat. Under category (3) 2,127½ acres were inspected and 356 acres or 16.7 per cent. were rejected for the same causes as in category (2).

From the number of crops rejected it is apparent that some distributors did not take sufficient care in the selection of growers and in having the seed properly treated with a fungicidal dressing before it was despatched to growers.

It is desirable that firms co-operating in this scheme should exercise care in selecting growers and in treating the seed with a suitable powder dressing before it is despatched to them.

LARGE-SCALE BARLEY VARIETY EXPERIMENTS.

These experiments were carried out at ten centres in seven counties, one in each of Counties Cork, Tipperary, Kilkenny, Kildare and Louth, two in Offaly and three in Wexford. The seed used for the experiments was the produce of the First Pedigree plots established at the Cereal Station, Ballinacurra, Co. Cork, in 1942. The area of the plots throughout was one statute acre. All the seed was dressed with Agrosan powder at the rates of 8 oz. per barrel of seed. The three varieties sown at all centres were Spratt-Archer 37 No. 3, Spratt-Archer 37 No. 3 x Victory 2 and Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 2.

Sowing conditions were favourable and all plots were sown by the 14th April.

At all centres the seed germinated well and at the end of May there was a good braird on all plots. There was no lodging and all plots showed early promise. Wireworm attack was responsible for the poor yields from the Birr plots. Quality in most cases was not as good as usual.

The names and addresses of the growers, the nature of the soil and sub-soil, the crops grown in the two previous years and the dates of sowing and harvesting are set out in Table I. In each case the first-mentioned date of harvesting was that of the two new varieties.

In Table II. are set out the weights of grain per statute acre, the commercial value of the grain as determined by independent valuers, and the total value of the grain including screenings which were valued at 6d. per stone. The values thus determined are not those which would have been obtained in the season 1943 during which the price of barley was fixed at 35/– per barrel, but they were based on an arbitrary price range closely related to the fixed price.

The results set out in Table II and Table III show that Spratt-Archer 37 No. 3 gave a higher average yield, and grain of lower nitrogen content and was, therefore, of better malting quality, than either of the two new varieties.

TABLE I.

Large-Scale Barley Variety Experiments, 1943.

Centre No.	Name and Address of Grower	Description of Soil	Previous Crops	Date of Sowing	Date of Harvesting
1	Wm. Tait, Rostellan, Co. Cork.	Medium Loam Sub-soil, Shale	1941 Barley ... 1942 Roots ...	16th March	3rd and 7th August
2	P. Byrne, Ballygrangans, Co. Wexford.	Sandy Loam Sub-soil, Gravel	1941 Barley ... 1942 Beet ...	24th ,,	6th ,, 11th ,,
3	D. Morris, Tomahurra, Enniscorthy.	Shale Loam Subsoil, Shale	1941 Barley ... 1942 Roots ...	19th ,,	8th ,, 11th ,,
4	Mrs. Segrave, Dunany, Dunleer.	Strong Loam Subsoil, Gravel	1941 Wheat ... 1942 Swedes	19th ,,	23rd ,, 30th ,,
5	M. Howlett, Ramsgrange, Wexford.	Stiff Loam Sub-soil, Shale	1941 Barley ... 1942 Roots ...	30th ,,	13th ,, 20th ,,
6	M. P. Minch, Rockfield, Athy.	Deep Loam Sub-soil, Gravel	1941 Barley ... 1942 Beet ...	11th ,,	9th ,, 12th ,,
7	Wm. Mullins, Duninga House, Goresbridge.	Strong Loam Gravel and Limestone	1941 New Meadow 1942 Wheat	6th April	25th ,, 31st ,,
8	D. O'Brien, Ballinamere, Tullamore.	Gravelly Loam Sub-soil Limestone	1941 Oats ... 1942 Turnips	31st March	16th ,, 18th ,,
9	J. Young, Garbally, Birr.	Light Loam Sub-soil Limestone	1941 Roots ... 1942 Wheat ...	14th April	9th ,, 15th Sept.
10	M. Carroll, Belleen, Nenagh.	Strong Loam Sub-soil Limestone	1941 Barley ... 1942 Clover ...	13th ,,	27th ,, 31st August

TABLE II.

Large-Scale Barley Variety Experiments, 1943.

Yield and Value of Grain per Statute Acre.

CENTRE	SPRATT-ARCHER 37 No. 3				SPRATT-ARCHER 37 No. 3 x VICTORY II				SPRATT-ARCHER 37 No. 3 H. 9 x HYBRID 4 B.1. No 2			
	Yield of Dressed Grain	Screenings	Value per Barrel	*Total Value including Screenings	Yield of Dressed Grain	Screenings	Value per Barrel	*Total Value including Screenings	Yield of Dressed Grain	Screenings	Value per Barrel	*Total Value including Screenings
	brls. sts.	sts.	s. d.	£ s. d.	brls. sts.	sts	s. d.	£ s. d	brls. sts.	sts.	s. d.	£ s. d.
Cork: Wm. Tait	12 12	4	35 3	22 11 5	11 1	3.5	34 9	19 6 2	11 8	3.5	35 1	20 5 2
Tipperary: M. Carroll	15 13	3.5	34 11	27 13 10	10 7	3.0	34 8	18 3 4	12 8	4.5	35 0	21 19 9
Offaly: J. Young	7 7	5	34 7	12 19 8	6 9	5.0	34 6	11 8 11	7 8	4.5	34 7	13 1 7
D. O'Brien	11 14	4	25 1	26 3 10	13 4	3.5	35 0	23 5 6	11 13	4.5	35 1	20 16 8
Kildare: M. P. Minch ...	12 11	3.5	35 6	22 12 2	13 3	4.0	35 3	23 6 10	11 10	3.5	35 6	20 14 5
Kilkenny: W. Mullins	10 11	5	35 1	18 17 5	9 6	4.5	34 10	16 8 10	7 11	4.5	35 0	13 9 4
Wexford: M. Howlett	14 0	3.5	34 11	24 10 7	13 7	3.5	34 8	23 7 7	9 8	4.0	34 8	16 10 0
P. Byrne	9 8	1.5	35 2	16 14 9	11 5	2.0	35 0	19 16 11	6 14	3.0	35 2	12 3 3
D. Morris	11 3	3.0	35 6	19 18 8	10 15	3.0	35 1	19 5 2	7 14	3.5	35 5	14 0 8
Louth: Mrs. Segrave	11 8	1.5	35 2	20 5 2	12 15	2.0	35 2	22 15 11	11 9	2 5	35 3	20 8 10
Total	120 7	34.0	—	212 7 6	112 8	34.0	—	197 5 2	98 7	38.0	—	173 9 5
Average ...	12 0.7	3.4	35 1	21 4 9	11 4	3.4	34 11	19 14 6	9 13.5	3.8	35 1	17 6 11

*Screenings valued at 6d. per stone.

TABLE III.

1943 Large-Scale Variety Experiment.

Analysis of Produce.

Grower	Spratt-Archer 37 No. 3				Spratt-Archer 37 No. 3 x Victory 2				Spratt-Archer 37 No. 3 H 9 x Hybrid 4 B 1 No. 2			
			On Dry Matter				On Dry Matter				On Dry Matter	
	Bushel Weight lb	Moisture %	Nitrogen %	Weight of 1,000 Corns grms.	Bushel Weight lb.	Moisture %	Nitrogen %	Weight of 1,000 Corns. grms.	Bushel Weight lb	Moisture %	Nitrogen %	Weight of 1,000 Corns grms.
Cork: Wm. Tait	52.5	18.4	1.41	31.4	51.9	17.8	1.52	31.4	53.2	18.0	1.60	33.0
Wexford: M. Howlett	51.6	20.6	1.42	33.6	51.2	19.0	1.63	33.2	49.6	18.8	1.57	27.2
P. Byrne	52.9	18.4	1.28	30.6	52.7	19.9	1.33	33.8	53.4	18.8	1.38	33.1
D. Morris	54.5	18.8	1.27	34.3	54.2	19.0	1.26	36.6	54.6	18.8	1.29	35.8
Kilkenny: W. Mullins	53.5	17.3	1.40	33.6	53.4	17.3	1.51	35.4	53.6	16.6	1.50	31.3
Kildare: M. P. Minch	55.4	18.8	1.29	34.2	54.8	19.0	1.31	36.7	56.2	18.4	1.44	37.6
Offaly: D. O'Brien	52.4	22.1	1.32	35.0	54.3	21.0	1.43	39.0	53.4	20.8	1.62	37.6
J. Young	49.2	19.6	1.42	29.8	49.0	20.2	1.34	33.3	50.0	20.0	1.55	32.8
Tipperary: M. Carroll	53.0	19.0	1.58	38.8	51.4	23.3	1.60	41.2	53.2	17.5	1.65	38.2
Louth: Mrs. Segrave	53.8	19.2	1.28	37.1	54.6	18.9	1.42	39.9	54.4	18.0	1.45	39.2
Total	528.8	192.2	13.70	338.4	527.5	195.4	14.35	360.5	531.6	186.3	15.05	348.8
Average	52.88	19.22	1.370	33.84	52.75	19.54	1.435	36.05	53.16	18.63	1.505	34.88

TABLE IV.

Half-Drill Strip Experiments, 1943.

	No. 1 EXPERIMENT						No. 2 EXPERIMENT					
	Spratt-Archer 37 No. 3 Field Plot			Spratt-Archer 37 No. 3 Second Pedigree			Spratt-Archer 37 No. 3 First Pedigree			Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 2		
		sts.	lb.		sts.	lb.		sts.	lb.		sts.	lb.
	a	2	12	B	3	6	a	3	2½	B	2	10
	C	2	10	b	3	7	C	3	6½	b	2	8½
	c	3	8½	D	3	2½	c	3	5	D	2	11
	E	3	7½	d	3	7½	E	3	2	d	2	9½
	e	3	3	F	3	5	e	3	4	F	2	9
	G	3	7	f	3	5	G	3	1	f	2	10½
	g	2	12	H	3	1	g	2	11	H	2	7
	I	2	12	h	3	1	I	3	1	h	2	10
	i	3	7	J	2	12	i	3	1	J	2	6½
	K	3	10	j	4	1	K	3	2½	j	2	9
	k	3	6½	L	3	9	k	3	2½	L	2	9½
	M	3	10½	l	3	8	M	3	–	l	2	9
	m	3	6	N	3	11½	m	3	2	N	2	9½
	P	4	1	n	3	6½	P	3	3	n	2	6
	p	3	10	Q	3	7	p	3	2	Q	2	7
	R	3	9	q	3	5	R	3	4	q	2	9
	r	3	10½	S	3	7½	r	3	1½	S	2	9½
	T	3	9½	s	3	7½	T	3	–½	s	2	8½
	t	3	4	V	3	6	t	3	1	V	2	8
	W	3	6	v	3	6	W	3	4	v	2	10
	w	3	2	X	2	12	w	3	–	X	2	7
	Y	3	7	x	3	0	Y	2	12	x	2	8
Total ..		75	3		74	8		68	12		57	10
Average lb. ..	47.86			47.47			43.82			36.73		
Average Moisture ..	17.0%			17.3%			17.3%			17.0%		
*Average Nitrogen	1.40%			1.38%			1.35%			1.41%		
*Average Weight of 1,000 Corns (grms.)	34.9			34.6			33.6			35.1		
Relative Malting Quality	100.8			100.0			100.0			98.0		

*On dry matter.

SMALL SCALE QUANTITATIVE EXPERIMENT, 1943.

This experiment was conducted in the cage at the Cereal Station. Eight varieties were sown in a series of randomized blocks, there being fourteen replicas of each variety :—

The varieties included were :—
Spratt-Archer 37 No. 3.
Spratt-Archer 37 No. 3. Selection No. 7.
Maja.
Beaven's 54/12/3.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 1/1.
" " x " No. ½.
" " x " No. 2.
" 37/9 x Golden Archer 2 No. 2.

The results set out in Table V show that the poor germination of Spratt-Archer 37 No. 3 resulted in a yield significantly below the average of the experiment. Apart from this the quality of the barley and the resultant malt was well up to standard.

Maja, though highest yielder, had a poor malting quality and makes unsuitable malting material.

Beaven's 54/12/3 was also significantly above the average in yield and is a very promising barley.

Excluding Spratt-Archer 37 No. 3, the last three barleys in the Table have yields somewhat below the average but the quality of these barleys is such as to merit their further trial.

Half-Drill Strip Experiments.

Two of these experiments were carried out on the farm of Messrs. J. H. Bennett, Ltd. Each trial consisted of twenty-two strips of each variety under test, a strip being half the width of the corn drill.

In No. 1 experiment the produce of the 1942 field plot of Spratt-Archer 37 No. 3 was tested against the produce of the second Pedigree plot of the same variety, the object being to ascertain if the younger generation was maintaining the desirable qualities of the older generation. To ensure even sowing the seed in each half of the corn drill was changed over for the sowing of the second half of the experiment. In order to maintain the sequence of the strips, the machine was driven up the field idle before commencing to sow the second half of the experiment.

The results which are set out in Table IV show that the returns from the two generations are very similar.

In No. 2 experiment, which was conducted in the same way as No. 1, Spratt-Archer 37 No. 3 was tested against Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 2. The results, which are also set out in Table IV, show that Spratt-Archer 37 No. 3 gave significantly higher yield and grain of better malting quality than the other variety.

TABLE V.

SMALL SCALE QUANTITATIVE EXPERIMENT, 1943.

AVERAGE OF FIFTEEN PLOTS.

Variety	No. of Plants	No. of Ears	Weight of Ears	Weight of Grain	*Nitrogen %	*Weight of 1,000 Corns	Relative Malting Quality
			grms.	grms.		grms.	
Maja	90.53	323.66	322.13	282.44	1.30	37.9	96.2
Beaven's 54/12/43 ..	94.73	277.80	308.67	272.65	1.20	38.2	100.7
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. ½	97.73	288.33	300.07	264.57	1.32	38.6	100.6
Spratt-Archer 37/9 x Golden Archer 2 No. 2	95.13	280.00	292.22	259.51	1.25	38.0	100.6
Spratt-Archer 37 No. 3 Selection No. VII ..	95.73	273.66	287.89	249.48	1.26	38.0	101.1
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 2	93.00	267.33	287.64	247.29	1.28	39.0	100.3
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. ¼	94.53	272.00	283.17	246.12	1.32	37.0	100.1
Spratt-Archer 37 No. 3	84.33	258.26	285.49	244.52	1.34	38.2	100.0

*On dry matter.

OATS.

Pure Line :—A single plant selection and a garden plot of Black Tartary Oats were grown at the Cereal Station in order to retain a Pure Line stock of this variety.

DEPARTMENT'S EXTENSION PLOTS.

In order to have available stocks of Pedigree seed oats for merchants and others interested in the distribution of Pedigree seed, stocks of Ardri, Victory II and Potato (Ardee) oats were grown under agreement with selected farmers in the neighbourhood of Ballinacurra. These stocks were grown, harvested and threshed under the Department's supervision. The produce was kiln-dried, cleaned and made available for distribution in the spring of 1944.

The following are the names and addresses of growers, together with the acreages and amounts of seed sown.

ARDRI.

		Acres	*Brls.*	*Sts.*
Mr. Wm. Tait, Buckstown, Rostellan	..	7	8	0
,, J. Hegarty, Ballinbeg, Rostellan ..	..	4	4	8
,, P. O'Keeffe, Ardra, Rostellan ..	..	4	4	8
,, J. B. Barter, Inchiquin, Killeagh	..	10	11	6
,, S. Northridge, Ballmacsliney, Midleton	..	6	6	12
TOTALS	..	31	35	6

VICTORY II.

		Acres	*Brls.*	*Sts.*
*Mr. Wm. Tait, Hermitage, Rostellan ..	..	11	12	8
,, M. O'Neill, Elfordstown, Midleton	..	4	4	8
,, R. Scanlon, Geragh, Ballinacurra	..	4	4	8
,, R. Barry, Broomfield, Midleton	..	7	8	—
Mrs. Bourke, Ballintotas, Midleton ..	..	4½	5	—
TOTALS	..	30½	34	10

POTATO ARDEE.

		Acres	*Brls.*	*Sts.*
*Mr. Wm. Tait, Hermitage, Rostellan ..	..	4½	5	—

*The seed sown at this centre was obtained at The Albert Agricultural College, Glasnevin, Dublin.

SCHEME FOR THE DISTRIBUTION OF PEDIGREE STOCKS OF SEED OATS.

Under the Department's scheme nucleus stocks of Pedigree Victory II and Ardri, which were propagated in the Ballinacurra district in 1942, were distributed to Seed Merchants and others in the spring of 1943.

These Pedigree stocks were supplied to merchants on condition that they would undertake to have the seed grown by reliable farmers, to purchase the produce, if suitable, and to retain it for seed purposes. In order to facilitate merchants, the Department arranged for the inspection by the Agricultural Instructors of the growing crops. Reports received at the end of the 1943 season indicated that in practically all cases the crops grown

from the Pedigree seed were likely to produce grain suitable for seed purposes. Consequently, merchants who participated in this Scheme and who took sufficient care in the selection of growers and in the subsequent handling of the produce, have large stocks of high-class home-grown seed oats available for sowing in the spring of 1944.

Under the above scheme, foundation stocks of Pedigree seed oats were supplied to the following in 1943 :—

ARDRI.

The Superintendent, Agricultural School, Athenry, Co. Galway.
,, ,, ,, Clonakilty, Co. Cork.
Messrs. M. Kelleher & Sons, Ltd., Tralee, Co. Kerry.
,, W. Drummond & Sons, Ltd., Dublin.
,, Universal Providing Stores, Edenderry.
,, Latchford & Sons, Ltd., Tralee.
,, Enniscorthy Co-Op. Agricultural Society, Enniscorthy.
,, E. Dowley & Sons, Ltd., Carrick-on-Suir, Co. Tipperary
,, J. H. Roche & Sons, Ltd., William Street, Limerick.
,, D. E. Williams, Ltd., Tullamore, Offaly.
,, Suttons, Ltd., 1, South Mall, Cork.
,, J. H. Bennett, Ltd., The Maltings, Ballinacurra. Co. Cork.
,, C. F. Bellew, Ltd., Drogheda, Co. Louth.
,, M. Rowan & Co., Ltd., Dublin.
,, John B. Hopkins & Sons, Ltd., Wicklow.
,, D. O'Connor, Ltd., Upper William Street, Wicklow.
,, J. Cunningham, Ballacolla, Leix.
,, D. Daly, Earl Street, Mullingar.
,, E. & F. McLysaght, Hazelwood, Mallow.
,, T. McKenzie & Sons, Ltd., Pearse Street, Dublin.
,, Donaghmore Co-Op. Creamery, Ltd., Ballybrophy, Leix.
,, Shelburne Co-Op. Creamery, Ltd., Campile, Co. Wexford.
,, Mitchelstown Co-Op. Agricultural Society, Mitchelstown, Co. Cork.
,, J. Callaghan & Sons, Glanworth, Co. Cork.
Mr. J. Fitzgerald, Drumcollogher, Charleville, Co. Cork.

Mr. N. P. Cotter, Agricultural Instructor, The Lodge, Roscommon.

Mr. Arthur J. Cope, Castledermot, Co. Kildare.

Senator W. J. O'Callaghan, Longueville, Mallow.

Mr. Wm. Bland, Rath House, Portarlington.

Captain H. M. S. Redmond, Popefield, Athy, Co. Kildare.

Mr. R. Lahiffe, Cloon House, Gort, Co. Galway.

Mr. Wm. Desmond, Coolenagh, Enniskeane, Co. Cork.

Victory II.

The Superintendent, Agricultural School, Athenry, Co. Galway.
,, ,, Ballyhaise, Co. Cavan.
,, ,, Clonakilty, Co. Cork.

Messrs. M. Kelleher & Sons, Ltd., Tralee, Co. Kerry.
,, J. Callaghan & Sons, Ltd., Glanworth, Co. Cork.
,, H. Good & Co., Ltd., Kinsale, Co. Cork.
,, J. H. Bennett, Ltd., Ballinacurra, Co. Cork.
,, McKenzies, Camden Quay, Cork.
,, Universal Providing Stores, Edenderry, Offaly.
,, E. Dowley & Sons, Ltd., Carrick-on-Suir, Co. Tipperary.
,, John P. Hopkins & Sons, Ltd., Wicklow.
,, E. Morrin & Sons, Ltd., Baltinglass, Co. Wicklow.
,, D. E. Williams, Ltd., Tullamore, Offaly.
,, E. Flahavan & Sons, Ltd., Kilnagrange Mills, Kilmacthomas.
,, F. A. Waller & Co., Ltd., The Maltings, Banagher, Offaly.
,, M. Rowan & Co., Ltd., Dublin.
,, W. Drummond & Sons, Ltd., Dublin.
,, Enniscorthy Co-Op. Agricultural Society, Ltd., Enniscorthy.
,, Shelburne Co-Op. Agricultural Society, Campile, Co. Wexford.

Mr. Garrett Byrne, Bree, Ballyhogue, Enniscorthy, Co. Wexford.
,, T. O'Sullivan, Cloughduv, Crookstown, Co. Cork.
,, D. Daly, Earl Street, Mullingar.
,, P. S. Murphy, Cloughleafin, Mitchelstown, Co. Cork.
,, J. Seymour, Monsea, Nenagh, Co. Tipperary.
,, M. J. Corry, T.D., Sunmount, Glounthane, Co. Cork.

Mr. J. H. Smyth, St. Johnston, Co. Donegal.

,, Wm. Duggan, Carrick-on-Suir, Co. Tipperary.

Messrs. W. & S. Armstrong, Enniscorthy, Co. Wexford.

Mr. J. N. Greene, Kilkea Lodge, Mageney, Co. Kildare.

The Albert Agricultural College co-operated with the Department in the working of the foregoing scheme and stocks were distributed as follows :—

Ardri.

Mr. H. R. Scanlan, Dublin Street, Balbriggan, Co. Dublin.

,, J. M. Dillon, T.D., Ballaghaderreen, Co. Mayo.

,, V. Baker, Cloughjordan, Co. Tipperary.

Reps. W. J. Burke, 31 Bridge Street, Skibbereen, Co. Cork.

Mr. J. P. Higgins, Fortland House, Easkey, Co. Sligo.

,, Patrick Hickey, Faranane House, Murroe, Co. Limerick.

,, Ml. Tumelty, Creggy, The Pigeons, Athlone.

,, J. J. Furlong, Littlegraigue, Duncormick, Co. Wexford.

,, B. Crombei, Knock, Daingean, Offaly.

,, F. Aiken, T.D., Sandyford, Co. Dublin.

Holy Faith Convent, Glasnevin, Dublin.

Mr. Jas. Moran, Sheriffstown, Moone, Co. Kildare.

Messrs. W. Drummond & Sons, Ltd., 58 Dawson Street, Dublin.

Mr. W. F. Tuthill, Moyglare House, Maynooth, Co. Kildare.

,, T. Caffrey, Coolock House, Coolock, Co. Dublin.

,, P. Smith, Tunnyduff, Co. Cavan.

Messrs. M. Rowan & Co., Ltd., 51/52 Capel Street, Dublin.

Glasnevin Success 10.

Messrs. J. H. Bennett, Ltd., The Maltings, Ballinacurra, Co. Cork.

,, Toradh Teo, 12 Dawson Street, Dublin.

Mr. L. Kavanagh, Balkinstown, Nurney, Co. Kildare.

,, P. Smith, Tunnyduff, Co. Cavan.

POTATO (ARDEE).

The Cereal Station, Ballinacurra, Co. Cork.

Mr. J. M. Dillon, T.D., Ballaghaderreen, Co. Mayo.

Agricultural School, Athenry, Co. Galway.

VICTORY-ARGENTINE.

Messrs. Toradh Teo, 12 Dawson Street, Dublin.

Mr. N. Goulding, Surgalstown, Swords, Co. Dublin.

VICTORY II.

The Cereal Station, Ballinacurra, Midleton, Co. Cork.

WHEAT.

RED MARVEL.

The Scheme for the provision of suitable seed for distribution in districts where Spring Wheats are usually grown was continued in 1943 on lines similar to those of previous years and an extension plot of 12 statute acres of pedigree Red Marvel Wheat was grown on the farm of Mr. Wm. Tait, Hermitage, Rostellan, Co. Cork. The produce of this wheat crop is now available for sowing in 1944 and will be distributed to farmers under contract through : Messrs. Minch, Norton & Co.

,, Rowan & Co.

,, Odlum Ltd.,

,, Irish Sugar Beet Growers' Association,

on condition that the produce of the 1944 crop, if suit ' le for seed, will be used for further propagation in 1945.

Flax.

At the Cereal Station, Ballinacurra, Co. Cork, an extension plot of Redwing is being grown and the following varieties are being compared for seed production: Redwing, Bison, Buda, Newlands, Argentine, Linseed, Concurrent.

Swedes.

At the Cereal Station, Ballinacurra, Co. Cork, seed stocks are being raised from selected roots.

FRUIT CROP REPORT, 1943.

From the fruit growers' point of view the year 1943 will be regarded generally as a disappointing one, but more particularly so in the case of the tree fruits, such as apples, pears, plums and damsons which nearly everywhere produced crops considerably below normal.

The season opened in a very promising manner with apple trees carrying plenty of blossom buds which expanded from seven to ten days earlier than usual, giving every indication of a bumper yield until the severe weather which occurred during May reduced crop prospects to almost negligible proportions. In some districts, however, early varieties of apples escaped fairly well and gave good returns.

Strawberries, Gooseberries and Black Currants produced good crops in nearly all the important areas, but Raspberry plantations suffered considerably from gales during May and, as a result, they were scarcely up to average production in exposed situations.

WEATHER CONDITIONS.

The weather during January and February was wet and unsettled, but temperatures were above normal, resulting in early development of buds. Applications of tar-oil sprays was attended by some risk in cases where other activities delayed this operation.

March and April were dry and fine, with the result that fruit blossoming was somewhat premature. Severe gales were experienced on the 24th and 25th April, and colder weather then developed and continued into May, with widespread frost between the 9th and 11th of the Month. Local snow was also reported, so that considerable harm was done to the blossoms of the tree fruits, which were not then past the danger stage, and it was quite easy to forecast by the end of the month that prospects of a satisfactory apple crop were very remote.

Of the summer months July was fine and warm, but June and August were, on the whole, unsettled, enabling apple scab to become rampant, particularly in unsprayed orchards.

From August to November the weather was unsettled, and in most areas the apple crop ripened much earlier than usual, so that before the end of September, picking was well advanced. Severe gales were experienced between the 18th and 20th of October, but, fortunately, harvesting was well ahead by this date and little loss occurred.

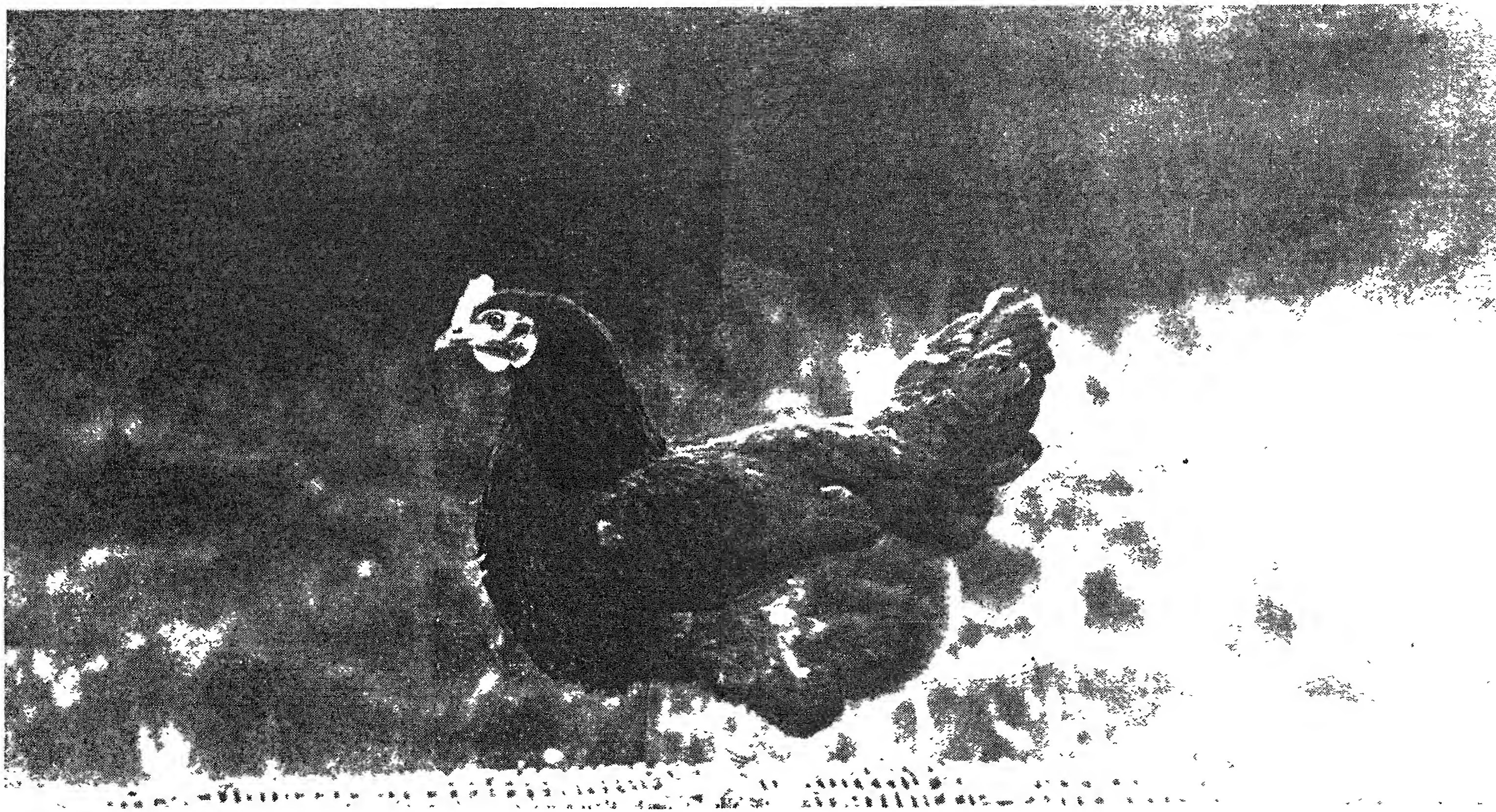
In December the weather improved and considerable progress with winter spraying was possible.

Reports indicated that apple scab appeared to be the most troublesome of the fungoid diseases, and even in sprayed orchards proved unusually difficult to control, while American Gooseberry mildew appeared to have been kept in check by routine spraying. Of insect pests Apple Sawfly was reported to be on the increase in certain areas and to have caused considerable damage to dessert varieties.

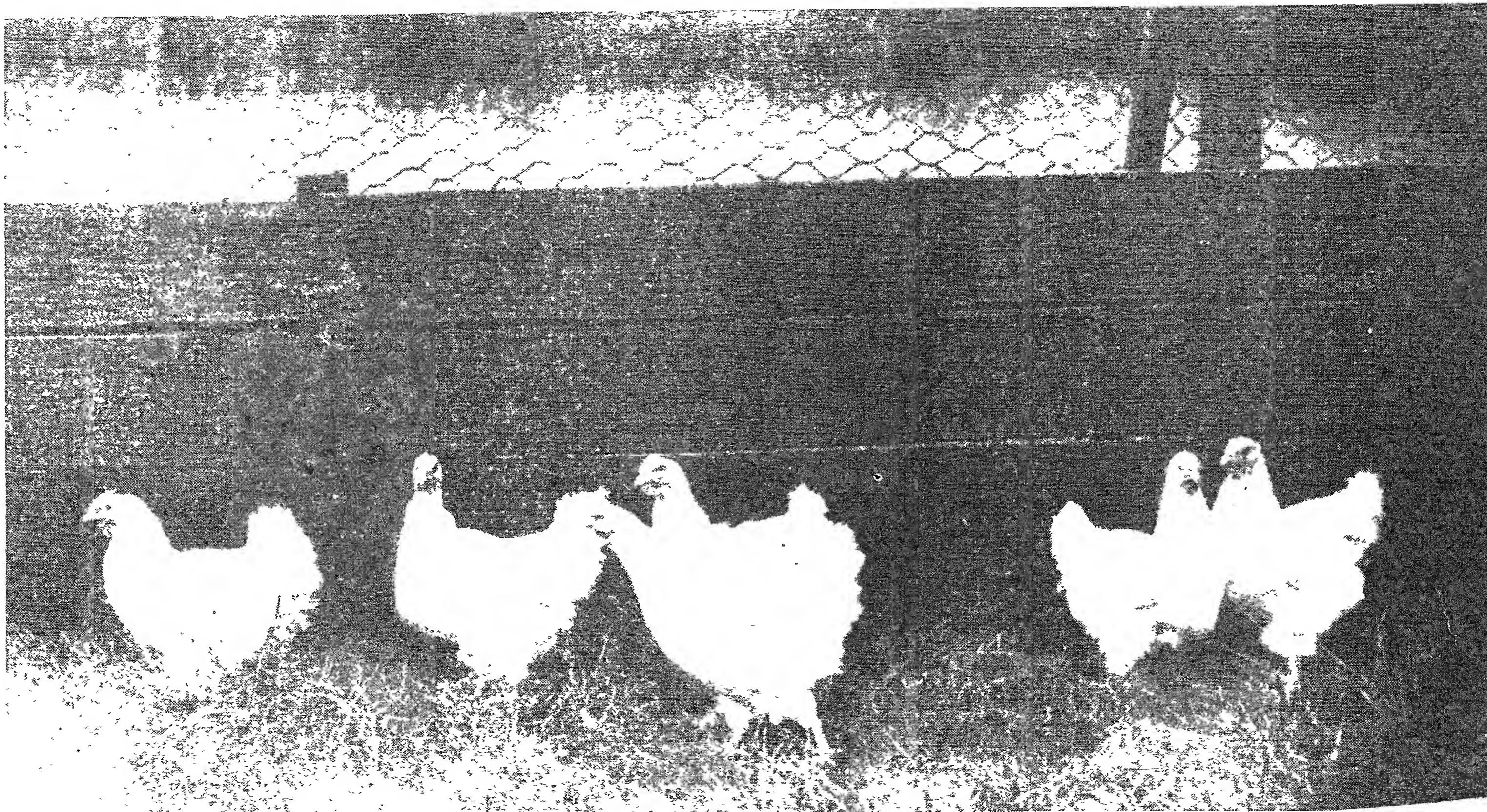
Table showing in a general way the nature of the yields obtained in each county.

County	Gooseberries	Strawberries	Raspberries	Black-currants	Apples	Plums and Damsons	Other Fruits
Carlow ...	Good	Very good	Good	Good	Bad	Below average	Poor
Cavan	Average	Good	Average	Good	Very bad	Poor	Below average
Clare	Light to average	Good	Average	Below average	Very bad	Poor	Below average
Cork	Good	Average	Below average	Below average	Very bad	Below average	Poor
Donegal .	Below average	Average	Good	Average to good	Very bad	Poor	Poor
Dublin	Below average	Very good	Good	Below average	Very bad	Average	Average to good
Galway	Good	Good	Below average	Below average	Bad	Below average	Poor
Kerry	Average to good	Good	Good	Good to very good	Bad	Poor	Poor
Kildare .	Below average	Average	Good	Below average	Below average	Poor	Poor
Kilkenny ...	Very good	Good	Good	Average	Bad	Very bad	Bad
Laoighis ...	Good	Average	Good	Average	Bad	Below average	Average
Leitrim .	Good	Good	Very good	Average	Bad	Bad	Bad
Limerick ..	Very good	Good	Good	Poor	Bad	Below average	Average
Longford ..	Average	Below average	Average	Very good	Very bad	Below average	Bad
Louth	Below average	Good	Good	Average	Very bad	Bad	Below average
Mayo	Average	Above average	Average	Average	Very bad	Below average	Average
Meath	Good	Good	Very good	Poor	Bad	Average	Below average
Monaghan ...	Good	Good	Good	Below average	Very bad	Bad	Bad
Offaly	Good	Very good	Below average	Below average	Very bad	Bad	Below average
Roscommon ...	Below average	Below average	Below average	Poor	Below average	Bad	Bad
Sligo	Good	Average	Good	Good	Very bad	Bad	Below average
Tipperary ...	Average	Good	Average to good	Above average	Bad	Below average	Poor to average
Waterford ...	Average	Good	Average	Average	Bad	Below average	Bad
Westmeath ...	Very good	Very good	Very good	Good	Very bad	Below average	Bad
Wexford ...	Good	Good	Good	Good	Very bad	Bad	Below average
Wicklow ...	Very good	Very good	Below average	Good	Very bad	Bad	Average

NATIONAL EGG-LAYING TEST, 1942-1943



Bird No. 191 (Pen No. 59, Rhode Island Red), owned by Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick, awarded the Special Prize for the bird (sitting breed) scoring the highest number of points during the Test.



Pen No. 31 (White Wyandotte), owned by Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan, which won the Silver Cup.

NATIONAL EGG-LAYING TEST, 1942-43.

The Thirty-first Egg-Laying Test, conducted by the Department of Agriculture, was held at the Munster Institute, Cork, during a period of 46 weeks, beginning on 1st October, 1942, and ending on 18th August, 1943. A total of 85 pens, each consisting of six pullets, having fulfilled the required conditions, was accepted and arranged in Sections as follows :—

Section I.—White Wyandotte	6 pens
Section II.—White Wyandotte (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1942)	21 ,,
Section III.—Rhode Island Red	19 ,,
Section IV.—Rhode Island Red (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1942)	16 ,,
Section V.—Any non-sitting breed	10 ,,
Section VI.—Any other utility breed	13 ,,

Station holders were, as heretofore, allowed to enter a second pen in one of the open sections on payment of the requisite entry fee.

Only pullets which were certified by the Veterinary College, Ballsbridge, Dublin, as being non-reactors to the agglutination test for bacillary white diarrhoea were accepted.

Minimum Weights. The following were the prescribed minimum weights for the respective breeds :—

All non-sitting breeds	..	3 lb.
White Wyandotte ..	..	4½ lb.
Rhode Island Red ..	..	4½ lb.
Plymouth Rocks ..	..	5 lb.
Sussex	..	5 lb.
Any other sitting breed	..	5 lb.

Eggs were graded as follows :—

Egg Grades. Special Grade.—$2\frac{1}{8}$ ozs. and over for the first eight weeks (1st October to 25th November, inclusive), $2\frac{1}{4}$ ozs. and over throughout the remainder of the test.

First Grade.—A minimum of $1\frac{15}{16}$ ozs. for the first eight weeks (1st October to 25th November, inclusive), and a minimum of 2 ozs. during the remainder of the test.

Eggs which weighed less than the weight prescribed for first grade were recorded but did not count for scoring purposes.

System of Scoring. The system of scoring for the award of prizes was as follows :—

(*a*) Only special and first-grade eggs were counted for scoring purposes.

(*b*) The scoring for each egg of these grades was similar and as follows :—

Three (3) points for the first 12 weeks (1st Oct. to 23rd Dec.).

Two (2) points for the next 24 weeks (24th Dec. to 9th June).

Three (3) points for the remaining 10 weeks (10th June to 18th August).

(*c*) Points were not awarded for eggs defective in colour, shape or shell texture, but all such eggs were included in the records of production.

Egg Yields. Making no allowance for deaths, the average number of eggs per bird was 172.9. The average number of eggs per bird for which a record for the full 46-week period was available was 180.4 (see Table II). The corresponding figures in the previous test were 177.3 and 188.6 respectively. The average production per bird during each of the twelve periods for each breed is given in Table III. One White Wyandotte and one Light Sussex laid only one egg each during the test.

Egg Size. Twenty-three pens produced more than 20 per cent. of eggs under first grade.

Egg Weights. The average weight of egg for each of the competing breeds is shown in Table IV. The average weight per dozen eggs for all breeds was 25.9 oz., as compared with 26.1 oz. for the previous test. In Table V are given the number and percentage of the

different grades of eggs for each breed in respect of birds which completed the full 46-week period.

Copper Rings. Of the 469 birds which completed the full 46-week period, 90 or 19.2 per cent. laid 200 or more special and first grade eggs and not more than 20 per cent. under first grade (see Table VI). Of these, 76 were leg-banded with numbered sealed copper rings (see Table VIII). Copper rings were withheld from the following 14 birds which were not suitable for breeding purposes :—

(*a*) BREED STANDARD DEFECTS :—
4 White Wyandotte.
6 Rhode Island Red.
2 White Leghorn.
1 Light Sussex.

(*b*) CONSTITUTIONAL DEFECTS :—
1 Rhode Island Red.

A total of 137 birds, representing 29.2 per cent. of the number surviving the full period of the test, laid over 169 but less than 200 special and first-grade eggs. Birds which laid more than 20 per cent. of eggs under first grade are not included in the foregoing total (see Table VII).

Mortality. During the course of the test 41 birds died, representing a mortality of 8.0 per cent., and a decrease of 1.4 per cent. as compared with the previous test. The deaths were confined to a small proportion of the pens, those occurring in seven being accountable for almost 44 per cent. of the total. The distribution of total deaths amongst pens was as follows :—

1 pen	5 deaths	
1 pen	3 ,,	
5 pens	2 ,,	each
23 pens	1 death	,,

In the remaining 55 pens all birds completed the test. Table IX gives particulars of the birds that died and the cause of death in each case. Analysis of the causes of death shows that, as in previous tests, peritonitis and oviductitis were responsible for a high proportion of the mortality. Tuberculosis, the incidence of which has been very low in recent years, was again the cause of a small number of deaths.

B.W.D. Test. At the conclusion of the test the birds were submitted to the agglutination test for bacillary white diarrhœa, and there were no reactors.

Feeding. For the first time in the series of tests the rations consisted solely of home-produced foods. The system of feeding was similar to that in previous tests. The birds were fed three times daily. The morning feed consisted of half the grain ration given as scratch feed in the litter; the mid-day feed of wet mash, and the evening feed of the remainder of the grain ration fed in troughs. Dry mash was fed *ad lib.* and was made up to the following formula :—

4½	parts	by weight	Barley Meal.
3½	,,	,,	Rolled Oats.
1	part	,,	Grass Meal.
1	,,	,,	Fish Meal.

The wet mash consisted of equal parts by weight of the dry mash and boiled potatoes. The morning grain feed was oats and the evening feed was made up of two parts oats and one part barley. Cabbage, kale, turnips and mangels were fed during winter and spring. Limestone grit was allowed *ad lib.*

The following quantities of foods were consumed :—

Mixed Meals	33,422 lb.
Potatoes	10,080 ,,
Grain	20,972 ,,
Limestone Grit	1,344 ,,

NOTES ON COMPETING BREEDS.

WHITE WYANDOTTE.

Sections I and II. With the exception of two of the twenty-seven pens the birds were typical, well-developed and free from faults. Many of them were slow in coming into lay and consequently the winter production was low. While the egg-yield for the whole period reached a fairly satisfactory level it was not up to that of the previous test, but egg size and quality were good. Mortality was lower than in the previous test. The pen (No. 31) in Section II which won the silver cup was owned by Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney. This owner is to be congratulated on the distinction of breeding for two years in succession the best pen in the test.

RHODE ISLAND RED.

Sections III and IV. The thirty-five pens generally were composed of birds of excellent colour, type and size. Under-developed birds and some which developed breed defects were, however, included in a few pens. Egg production reached a high level and egg size also was satisfactory, but some individual birds produced defective eggs. Mortality was somewhat higher than in the previous test.

ANY NON-SITTING BREED.

Section V. The majority of the ten pens was made up of well-developed birds of good quality. One pen was very backward on arrival and took a long time to come into full production. A few pens included undersized birds. The egg-yield was lower than in the previous test, but egg size and quality were good. The health of the birds was very satisfactory.

ANY OTHER UTILITY BREED.

Section VI. This Section comprised eleven pens of Light Sussex and two pens of Buff Plymouth Rocks. The Light Sussex birds, generally, were not of satisfactory quality, but a few good pens were included. Many birds were undersized and immature on arrival and the production during the test was low. The egg size in a number of the pens was not up to standard, but the egg quality and the health of the birds were good. The Buff Plymouth Rocks were of fair quality but those in one pen were small and immature on arrival. Production was poor but egg size and quality were up to standard.

CONCLUSION.

The results of the test were quite satisfactory having regard to the prevailing conditions. The health of the birds was very good. The level of production, particularly in Sections III and IV, was well up to the standards of previous tests. It is obvious, therefore, that satisfactory results can be secured from the sole use of home-produced foods. The low egg yield in the early months was due to the under-development and immaturity of a number of birds on arrival for the test. Under the newly adopted method of scoring as indicated on page 4, it is important that birds sent to the test should have started to lay, or at least be at the point of production, at the commencement of the test.

TABLE I.

The following Table shows the egg production for each of the thirty-one tests held since 1912-13 :—

Forty-eight weeks ended	No. of Birds	No. of Eggs Laid	Average Number per Bird
31st Aug., 1913	318	38,199	120.1
„ 1914	282	39,216	139.0
„ 1915	264	39,764	150.6
„ 1916	294	49,830	169.5
„ 1917	210	36,660	174.6
„ 1918	210	36,106	171.9
„ 1919	306	55,124	180.0
„ 1920	354	65,840	186.0
„ 1921	288	51,584	179.0
9th Sept., 1922	342	63,518	185.7
16th „ 1923	198	38,519	194.5
15th „ 1924	342	61,144	178.8
15th „ 1925	348	63,755	183.2
15th „ 1926	342	65,137	190.4
16th „ 1927	492	93,912	190.9
16th „ 1928	510	95,226	186.7
16th „ 1929	540	101,820	188.6
16th „ 1930	588	100,752	171.3
16th „ 1931	588	111,180	189.1
15th „ 1932	600	111,986	186.6
12th „ 1933	606	113,047	186.5
10th „ 1934	606	112,177	185.1
7th „ 1935	702	131,384	187.1
3rd „ 1936	702	130,940	186.5
Forty-six weeks ended			
18th Aug., 1937	708	125,621	177.4
18th „ 1938	678	126,143	186.1
18th „ 1939	708	133,306	188.3
17th „ 1940	672	121,250	180.4
18th „ 1941	642	114,617	178.5
18th „ 1942	438	77,640	177.3
18th „ 1943	510	88,167	172.9

It should be noted that the figures given in Table I above are based on the total number of birds competing, no allowance having been made in respect of deaths.

Taking the birds which died during the 1942-43 test into account only up to the date of death, the average number of birds for the whole period was 495.4 and the average number of eggs per bird 178.0.

Table II.

Average Egg Yield for each Breed.

Breed	Number of Birds for full period	Number of Eggs Laid	Average Number of Eggs per Bird	Grade Averages per Bird		
				Special	First	Under First
White Wyandotte ..	151	26,453	175.2	81.0	75.6	18.6
Rhode Island Red ..	189	36,040	190.7	71.3	93.0	26.4
White Leghorn ..	55	10.002	181.9	70.3	94.3	17.3
Light Sussex	63	10,502	166.7	53.7	80.9	32.1
Buff Rock	11	1,619	147.2	91.2	51.9	4.1
All Breeds	469	84,616	180.4	72.4	85.0	23.0

Table III.

Average Egg Yield per Bird during each of the Twelve Periods.

Breed	Number of Birds for full period	Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Average for full period
White Wyandotte	151	8.7	13.2	13.2	14.1	16.4	18.3	20.1	18.2	16.8	15.2	14.0	7.0	175.2
Rhode Island Red	189	6.9	12.0	14.8	16.2	18.0	19.1	22.3	21.3	19.5	17.5	15.8	7.3	190.7
White Leghorn ..	55	6.5	10.4	10.5	13.8	18.4	18.8	21.6	20.9	20.1	17.8	16.2	6.9	181.9
Light Sussex ...	63	6.0	10.8	13.0	13.5	17.1	18.3	21.0	17.9	16.1	14.1	13.4	5.5	166.7
Buff Rock ...	11	5.5	8.7	11.7	14.5	16.5	18.6	18.2	14 4	12.5	11.7	8.9	6.0	147.2
All Breeds ..	469	7.3	11 9	13.4	14.8	17.4	18.7	21.3	19.6	18.1	16.2	14.8	6.9	180.4

TABLE IV.

Average Weight of Egg for each Breed.

BREED	Total Number of Eggs Laid	Total Weight of Eggs	Average Weight of Egg	Average Weight per Dozen
		lb. oz. dr.	*oz. dr.*	*oz.*
White Wyandotte ..	27,683	3,779 5 1	2 3	26.2
Rhode Island Red ..	37,443	5,029 10 1	2 2	25.8
White Leghorn ..	10,504	1,416 12 11	2 3	25.9
Light Sussex	10,883	1,441 13 4	2 2	25.4
Buff Rock	1,654	234 5 7	2 4	27.2
All Breeds ..	88,167	11,901 14 8	2 3	25.9

TABLE V.

Number and Percentage of Special, First and under First Grade Eggs for each Breed in respect of Birds which completed the full 46-week Period.

BREED	EGGS LAID			PERCENTAGE DISTRIBUTION		
	Special Grade	First Grade	Under First Grade	Special Grade	First Grade	Under First Grade
				%	%	%
White Wyandotte ..	12,228	11,415	2,810	46.2	43.2	10.6
Rhode Island Red ..	13,468	17,587	4,985	37.4	48.8	13.8
White Leghorn ..	3,868	5,184	950	38.7	51.8	9.5
Light Sussex	3,383	5,094	2,025	32.2	48.5	19.3
Buff Rock	1,003	571	45	62.0	35.2	2.8
All Breeds ..	33,950	39,851	10,815	40.1	47.1	12.8

TABLE VI.

Number and Percentage of Birds which laid 200 Special and First Grade Eggs or over, and not more than twenty per cent. under First Grade.

BREED	Number of Birds for full Period	Number of Birds which laid 200 Special and First Grade Eggs or over	Percentage
			%
White Wyandotte	151	28	18.5
Rhode Island Red	189	48	25.4
White Leghorn	55	9	16.4
Light Sussex	63	4	6.3
Buff Rock	11	1	9.1
All Breeds	469	90	19.2

TABLE VII.

Number and Percentage of Birds which laid over 169 but less than 200 Special and First Grade Eggs and not more than 20 per cent. under First Grade. The figures are based on the number of birds which completed the Test.

BREED	Number of Birds	Percentage
		%
White Wyandotte	42	27.8
Rhode Island Red	55	29.1
White Leghorn	24	43.6
Light Sussex	14	22.2
Buff Rock	2	18.2
All Breeds	137	29.2

Table VIII.

Egg Records of Birds which were awarded Copper Rings.

White Wyandotte (24 Birds).

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
2	8 10 12	2442 2443 2444	131 106 38	76 104 174	2 2 37	209 212 249	Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.
3	15	2445	166	43	—	209	Sister-in-Charge, St. Martha's College, Navan, Co. Meath.
6	32	2446	69	156	15	220	Mrs. J. R. Boyd, The Rectory, Killaloe, Co. Clare.
31	404 405	2447 2448	126 79	105 162	5 15	236 256	Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan.
32	43	2449	102	119	12	233	Mrs. M. Gammons, Ladyrath, Wilkinstown, Navan, Co. Meath.
33	49	2450	191	14	2	207	Mrs. D. Heaverin, Cortoon, Brownsgrove, Tuam, Co. Galway.
34	56	2451	60	155	8	223	Mrs. M. F. Bailey, Shanavaughy, Ballacolla, Laoighis.
37	72	2452	159	50	4	213	Mrs. R. B. Eadie, The Poplars, Beaufort, Co. Kerry.
38	74	2453	160	40	2	202	Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.
44	103 104 108	2454 2455 2456	207 175 156	4 34 54	— 2 17	211 211 227	Mr. W. Barron, "Woodview," Gortrush, Piltown, Co. Kilkenny

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
45	110	2457	178	22	3	203	Mrs. B. Martin, Corglass, Kingscourt, Co. Cavan.
46	115 118 119	2458 2459 2460	195 197 182	25 18 41	— 1 —	220 216 223	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.
47	125	2461	195	8	—	203	Miss M. O'Keeffe, Ballybooden, Knocktopher, Co. Kilkenny.
49	138	2462	2	203	15	220	Mrs. J. O'Connell, Athgoe, Straffan P.O., (Co. Dublin).
50	143	2463	149	55	3	207	Mrs. C. Towey, Silverfield, Lisacul, Ballaghaderreen, Co. Roscommon.
51	145	2464	188	25	1	214	Mrs. E. M. J. Condron, Knocktemple, Virginia, Co. Cavan.
52	153	2465	218	1	—	219	Mrs. E. Kennedy, Ballyroe, Freshford, Co. Kilkenny.

Rhode Island Red (41 Birds).

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
53	159	2466	65	145	2	212	Mrs. K. Sammon, Carrigahorig, Lorrha, Birr, Offaly.
58	182 184	2467 2468	42 128	184 73	6 1	232 202	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner
			Special Grade	First Grade	Under First Grade	Total	
59	188 189 190 191	2469 2470 2471 2472	192 20 134 151	28 203 95 97	2 10 3 2	222 233 232 250	Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.
62	205	2473	157	44	1	202	Miss M. Keane, Killurin, Wexford.
63	211 214	2474 2475	218 166	9 61	— 2	227 229	Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.
64	217	2476	111	95	6	212	Mrs. K. Cuddihy, Hillside P.F., Glenmore, Co. Kilkenny.
65	228	2477	179	49	—	228	Mrs. A. M. Lynch, Athgoe Villa, Straffan, (Co. Dublin).
66	230	2478	44	169	15	228	Mrs. K. Earl, Grantstown House, Waterford.
68	243 244 245	2479 2480 2481	194 44 126	20 173 76	— 4 2	214 221 204	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.
72	261 263	2482 2483	54 9	156 205	13 26	223 240	Mrs. N. O'Sullivan, Hill View, Bandon, Co. Cork.
74	271	2484	51	154	8	213	Mrs. K. Sammon, Carrigahorig, Lorrha, Birr, Offaly.
75	279	2485	68	146	2	216	Mrs. E. McDonnell, Emila, Ballyferriter, Dingle, Co. Kerry.
76	284 285	2486 2487	65 34	150 167	2 5	217 206	Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.
78	297 299	2488 2489	99 207	113 6	1 —	213 213	Mrs. L. Hayes, Walshestown, Castlemahon, Newcastle West, Co. Limerick.

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
80	307 308 310 312	2490 2491 2492 2493	199 23 108 51	33 180 103 149	2 18 3 18	234 221 214 218	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.
81	313 316	2494 2495	71 202	142 6	8 —	221 208	Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.
82	319 320	2496 2497	83 228	122 24	3 1	208 253	Mrs. E. Hammersley, Ashvale, Lattin, Tipperary.
83	328	2498	57	146	15	218	Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.
84	331 332	2499 2500	157 85	45 133	3 14	205 232	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.
102	343	2501	42	172	14	228	Mrs. E. M. O'Flynn, Prohurst House, Milford, Charleville, Co. Cork.
103	353	2502	78	159	3	240	Mrs. S. Collier, Boggon, Kilbride, Tullow, Co. Carlow.
104	357 360	2504 2505	56 86	144 140	2 2	202 228	Mrs. M. Browne, Ballybane, Firies, Co. Kerry.
105	362 364	2506 2507	87 46	133 179	— 6	220 231	Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.

White Leghorn (7 Birds).

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
89	482 485	1812 1813	75 31	129 199	2 6	206 236	Mrs. M. O'Shea, Farrantane, Castlegregory, Co. Kerry.

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	First Grade	Under First Grade	Total	Name and Address of Owner
90	487	1814	47	153	13	213	Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.
92	500	1815	133	75	3	211	Mrs. F. E. Hanbidge, Blackrath, Ballytore, Co. Kildare.
93	510	1816	139	85	1	225	Sister-in-Charge, St. Martha's College, Navan, Co. Meath.
94	515	1817	199	6	—	205	Sister-in-Charge, R.D.E. School, Swinford, Co. Mayo.
95	521	1818	101	99	1	201	Mrs. M. A. Walsh, Wardstown, Athboy, Co. Meath.

Light Sussex (3 Birds).

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner
			Special Grade	First Grade	Under First Grade	Total	
115	371	2508	176	52	1	229	Mrs. A. Murphy, Brittas, Inistioge, Thomastown, Co. Kilkenny.
116	376 377	2509 2510	46 14	154 186	26 14	226 214	Mrs. J. Hely-Hutchinson, Lissen Hall, Swords, Co. Dublin.

Buff Rock (1 Bird).

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid				Name and Address of Owner
			Special Grade	First Grade	Under First Grade	Total	
118	389	2511	179	35	—	214	Mrs. A. Coleman, Ballycullen House, Croom, Co. Limerick.

TABLE IX.

Results of post-mortem examinations performed by the Veterinary College.

Date of Death	Number of Bird	Number of Pen	Breed	Result of Post-mortem Examination
1942				
Oct. 29	79	39	White Wyandotte	Peritonitis and oopheritis.
Nov. 2	303	79	Rhode Island Red	Neuro-lymphomatosis.
,, 6	187	59	Rhode Island Red	Tumours (Sarcomata).
Dec. 12	292	77	Rhode Island Red	Obstruction of the trachea.
,, 21	294	77	Rhode Island Red	Enteritis.
,, 28	167	54	Rhode Island Red	Ulceration of the proventriculus.
1943				
Jan. 7	229	66	Rhode Island Red	Leukæmia.
Mar. 2	134	49	White Wyandotte	Peritonitis.
,, 3	532	97	White Leghorn	Neuro-lymphomatosis.
,, 12	137	49	White Wyandotte	Enteritis.
,, 18	289	77	Rhode Island Red	Tuberculosis.
,, 26	293	77	Rhode Island Red	Worm infestation.
April 12	370	115	Light Sussex	Oviductitis and peritonitis.
,, 12	166	54	Rhode Island Red	Vent gleet.
,, 15	291	77	Rhode Island Red	Rupture of a fatty liver.
,, 16	48	32	White Wyandotte	Chronic inflammation of the gizzard.
,, 27	248	69	Rhode Island Red	Vent gleet.
,, 27	252	69	Rhode Island Red	Neuro-lymphomatosis.
,, 29	350	103	Rhode Island Red	Peritonitis.
May 3	197	60	Rhode Island Red	Capillaria infestation.
,, 3	330	83	Rhode Island Red	Inflammation of the heart valves and ovary.
,, 18	520	95	White Leghorn	Peritonitis.
,, 19	477	114	Light Sussex	Oviductitis and peritonitis.
,, 22	6	30	White Wyandotte	Oviductitis and peritonitis.
,, 24	387	118	Buff Rock	Tuberculosis and fatty ruptured liver.
,, 24	149	51	White Wyandotte	Peritonitis and oviductitis.
,, 27	186	58	Rhode Island Red	Tuberculosis.
June 15	87	40	White Wyandotte	Peritonitis.
,, 15	361	105	Rhode Island Red	Tuberculosis.
July 5	311	80	Rhode Island Red	Rupture of tubercular liver.
,, 7	526	96	White Leghorn	Peritonitis.
,, 10	531	97	White Leghorn	Lymphomatosis of the ovary and heart.
,, 12	35	6	White Wyandotte	Rupture of a fatty liver.
,, 12	64	35	White Wyandotte	Peritonitis and tapeworm infestation.
,, 16	46	32	White Wyandotte	Peritonitis.
,, 20	309	80	Rhode Island Red	Leukæmia and peritonitis.
,, 22	278	75	Rhode Island Red	Peritonitis.
,, 29	249	69	Rhode Island Red	Neuro-lymphomatosis.
Aug. 3	14	3	White Wyandotte	Oviductitis, peritonitis and tapeworm infestation.
,, 5	429	106	Light Sussex	Peritonitis.
,, 10	536	98	White Leghorn	Roup and tapeworm infestation.

TABLE X.

Number and Percentage of Deaths for each Breed.

Breed	Number of Birds Penned	Number of Deaths	Percentage of Deaths
			%
White Wyandotte	162	11	6.8
Rhode Island Red	210	21	10.0
White Leghorn	60	5	8.3
Light Sussex	66	3	4.5
Buff Rock	12	1	8.3
All Breeds	510	41	8.0

SECTION PRIZES.

SECTION I—WHITE WYANDOTTE.

	Owner of Pen	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.	2,767	1,159
Second Prize (£7) :	Sister-in-Charge, St. Martha's College, Navan, Co. Meath.	2,515	1,059
Third Prize (£5) :	Mrs. M. Nagle, Springmount, Mallow, Co. Cork.	2,456	1,008
Fourth Prize (£4) :	Mrs. J. R. Boyd, The Rectory, Killaloe, Co. Clare.	2,397	989
Fifth Prize (£2) :	Mr. W. Barron, "Woodview," Gortrush, Piltown, Co. Kilkenny.	2,176	909

Section II——White Wyandotte (Station Holders).

	Owner of Pen	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan.	3,097	1,291
Second Prize (£7) :	Mr. W. Barron, "Woodview," Gortrush, Piltown, Co. Kilkenny.	2,735	1,128
Third Prize (£5) :	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.	2,690	1,122
Fourth Prize (£4) :	Mrs. D. Heaverin, Cortoon, Brownsgrove, Tuam, Co. Galway.	2,585	1,085
Fifth Prize (£2) :	Mrs. C. Towey, Silverfield, Lisacul, Ballaghaderreen, Co. Roscommon.	2,450	1,028

Section III—Rhode Island Red.

	Owner of Pen	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Mrs. K. Sammon, Carrigahorig, Lorrha. Birr, Offaly.	2,783	1,162
Second Prize (£7) :	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.	2,710	1,122
Third Prize (£5) :	Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford.	2,652	1,110
Fourth Prize (£4) :	Mrs. A. M. Lynch, Athgoe Villa, Straffan, (Co. Dublin).	2,573	1,091
Fifth Prize (£2) :	Mr. D. H. Edwards, Drumgowan, Burt, Co. Donegal.	2,350	998

Section IV—Rhode Island Red (Station Holders).

	Owner of Pen	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	2,838	1,191
Second Prize (£7) :	Miss C. Mealiff, Ballinamona House, Tullamore, Offaly.	2,722	1,132
Third Prize (£5) :	Mrs. E. Hammersley, Ashvale Lattin, Tipperary.	2,675	1,126
Fourth Prize (£4) :	Mrs. M. Browne, Ballybane, Firies, Co. Kerry.	2,598	1,091
Fifth Prize (£2) :	Mrs. L. Hayes, Walshestown, Castlemahon, Newcastle West, Co. Limerick.	2,574	1,083

Section V—Any Non-Sitting Breed.

	Owner of Pen	Breed	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Mrs. M. O'Shea, Farrantane, Castlegregory, Co. Kerry.	White Leghorn	2,776	1,148
Second Prize (£7) :	Mrs. A. Collins, Imanemore, Barnaderg, Co. Galway.	do.	2,526	1,067
Third Prize (£5) :	Sister-in-Charge, St. Martha's College, Navan, Co. Meath.	do.	2,525	1,093
Fourth Prize (£4) :	Sister-in-Charge, Rural Domestic Economy School, Swinford, Co. Mayo.	do.	2,509	1,050
Fifth Prize (£2) :	Mrs. F. E. Hanbidge, Blackrath, Ballytore, Co. Kildare.	do.	2,206	942

Section VI—Any Other Utility Breed.

	Owner of Pen	Breed	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Sister-in-Charge, St. Martha's College, Navan, Co. Meath .	Light Sussex	2,274	969
Second Prize (£7) :	Mrs. M. Keatley, Boakefield, Ballytore, Co. Kildare.	do.	2,231	936
Third Prize (£5) :	Miss M. Mullen, Lisaniskea, Clara, Offaly.	do.	2,203	918

SPECIAL PRIZES.

The Special Prize of a Silver Cup (or its value, £10) for the *Pen* of birds scoring the highest number of points during the Test has been awarded to Mrs. E. Hillis, Corrush, Doohamlet, Castleblayney, Co. Monaghan, for Pen No. 31 (White Wyandotte) which scored 3,097 points and which also won first prize in Section II.

The Special Prize of a Silver Medal (or £2) for the *Pen* of birds of non-sitting breed scoring the highest number of points during the period from 1st October to 23rd December, inclusive, has been awarded to the Sister-in-Charge, Rural Domestic Economy School, Swinford, Co. Mayo, for Pen No. 94 (White Leghorn) which scored 525 points during this period.

The Special Prize of a Silver Medal (or £2) for the *Pen* of birds of sitting breed scoring the highest number of points during the period from 1st October to 23rd December, inclusive, has been awarded to Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford, for Pen No. 63 (Rhode Island Red) which scored 807 points during this period.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of non-sitting breed scoring the highest number of points during the Test has been awarded to Mrs. M. O'Shea, Farrantane, Castlegregory, Co. Kerry, for Bird No. 485 (Pen No. 89, White Leghorn) which scored 556 points.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of sitting breed scoring the highest number of points during the Test has been awarded to Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick, for Bird No. 191 (Pen No. 59, Rhode Island Red) which scored 613 points.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of non-sitting breed scoring the highest number of points during the period from 1st October to 23rd December, inclusive, has been awarded to Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick, for Bird No. 487 (Pen No. 90, White Leghorn) which scored 120 points during this period.

The Special Prize of a Silver Medal (or £2) for the *Individual Bird* of sitting breed scoring the highest number of points during the period from 1st October to 23rd December, inclusive, has been awarded to Mr. W. Murphy, Skeeter Park, Cleariestown, Co. Wexford, for Bird No. 214 (Pen No. 63, Rhode Island Red) which scored 198 points during this period.

SECTION I. —WHITE WYANDOTTE—6 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 28	Scoring Points per Bird: Full Period	Oct. 1–Dec. 28	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
1	2	Mrs. M. O. Roberts,	Feb. 9	7	6 8	7 13	12	17	10	14	18	21	17	17	10	15	11	5	150	16	1	167	—	38	401	114	2 5	—	(a) 1,213 Eggs
		Lakemount,	Jan. 31	8	6 8	8 7	19	20	16	21	20	16	19	19	18	17	16	8	131	76	2	209	—	53	508	159	2 4	—	
		Glanmire,	"	9	6 4	6 11	20	16	15	17	21	23	19	18	15	15	16	7	95	100	7	202	2	45	168	132	2 3	—	(b) 26.5 oz.
		Co. Cork	Feb. 9	10	6 8	7 3	1	17	19	20	19	23	27	25	26	24	1	7	106	104	2	212	—	37	190	111	2 3	—	
			Mar. 3	11	6 8	8 3	—	-	6	19	17	18	24	21	20	19	18	9	104	67	3	174	—	3	391	9	2 3	—	(c) 2,767 Points
			Feb. 21	12	6 8	7 11	20	23	20	20	19	24	23	25	20	22	22	11	38	171	37	249	—	30	509	90	2 2	—	
2	3	Sister-in-Charge,	Feb. 7	13	5 8	6 15	- -	7	6	17	16	19	22	18	19	19	20	10	154	15	4	173	—	11	398	33	2 5	—	(a) 1,080 Eggs.
		St. Martha's College	"	14	4 12	D	15	13	19	19	17	20	21	25	22	11	D 2	—	85	97	5	187	—	43	122	129	2 3	—	
		Navan,	Feb. 23	15	5 2	7 0	19	17	16	16	18	17	19	22	18	19	17	11	166	43	-	209	-	52	517	156	2 5	—	(b) 27.0 oz.
		Co. Meath.	"	16	4 8	6 0	7	14	18	17	20	19	17	13	17	16	12	7	158	20	1	179	- -	38	131	114	2 6	-	
			Feb. 7	17	4 8	5 0	-	—	6	15	16	15	18	20	20	16	14	- -	26	111	3	140	—	5	308	15	2 3	-	(c) 2,515 Points
			"	18	5 12	5 12	19	19	18	19	16	21	18	22	19	20	—	-	55	130	7	192	1	52	439	156	2 2	- -	
3	7	Mrs. M. Nagle	February	37	4 10	5 8	22	18	16	20	18	18	25	27	12	24	11	13	28	167	29	224	-	50	479	150	2 1	1	(a) 1,187 Eggs
		Springmount	March	38	5 8	6 11	16	23	21	16	20	21	25	13	14	21	8	8	59	124	26	209	1	43	443	129	2 2	1	
		Mallow,	"	39	5 0	7 11	17	19	17	1	—	8	27	16	20	23	15	10	26	139	8	173	--	50	424	150	2 2	1	(b) 25.3 oz.
		Co. Cork	"	40	4 15	6 10	4	25	12	22	20	22	22	16	18	15	14	12	15	116	71	202	--	18	311	39	2 0	1	
			"	41	4 9	6 15	- -	9	21	20	21	22	23	20	12	12	16	9	18	128	39	185	—	10	339	30	2 1	—	(c) 2,456 Points
			"	42	4 8	6 10	2	21	17	11	14	22	22	21	19	18	17	10	140	49	5	194	—	37	460	111	2 4	--	
4	6	Mrs. J. R. Boyd,	March 27	31	5 8	7 8	20	17	14	17	11	16	16	10	15	11	15	5	55	94	18	167	--	33	362	99	2 2	--	(a) 1,104 Eggs
		The Rectory,	"	32	4 12	5 11	18	17	18	17	18	20	21	20	20	21	21	9	69	136	15	220	—	38	499	114	2 2	---	
		Killaloe,	"	33	5 0	5 4	—	19	18	6	1	17	19	18	10	12	15	—	22	70	37	129	-	30	241	90	2 1	3	(b) 25.7 oz.
		Co. Clare	"	34	4 12	6 7	15	17	17	5	3	18	20	22	23	20	16	10	11	148	27	186	1	27	339	81	2 1	—	
			"	35	5 5	D	21	21	18	19	24	24	21	21	19	19	D	--	66	128	13	207	3	47	448	111	2 2	--	(c) 2,397 Points
			"	36	5 0	7 4	—	8	17	21	21	21	20	21	21	20	17	8	158	37	—	195	1	25	458	75	2 5	—	
5	5	Mr. W. Barron,	Feb. 18	25	4 9	7 4	—	9	12	13	19	21	22	21	24	20	24	9	191	3	—	194	—	21	462	63	2 7	—	(a) 1,077 Eggs
		Woodview,	"	26	5 3	7 4	12	18	18	21	21	21	18	16	15	16	17	7	161	32	4	200	—	44	476	132	2 5	—	
		Gortrush,	"	27	4 12	6 11	17	14	17	17	13	19	17	21	18	20	17	8	134	61	3	198	—	45	480	135	2 4	—	(b) 26.8 oz.
		Piltown,	"	28	4 12	6 4	5	16	13	18	18	22	21	20	18	13	13	7	169	15	—	184	—	34	435	102	2 5	—	
		Co. Kilkenny.	"	29	4 8	6 8	—	8	12	17	12	11	11	5	7	5	—	3	5	16	72	91	—	3	43	9	1 14	—	(c) 2,176 Points
			"	30	4 8	5 11	19	21	16	10	19	16	26	23	25	9	16	10	6	115	89	210	—	7	280	21	2 0	1	

D = Dead.

SECTION I.—WHITE WYANDOTTE—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct 1–Dec 23	Scoring Points per Bird: Full Period	Oct. 1–Dec 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	
6	4	Miss V. Burdon,	April 5	19	4 15	6 9	7	19	14	3	17	15	22	21	16	21	18	6	70	80	29	179	—	15	360	45	2 2	—	(a) 1,025 Eggs
		The Laurels,	March 5	20	5 10	7 5	4	14	13	17	18	21	21	11	16	12	16	5	138	27	3	168	—	29	302	87	2 5	1	
		Buttevant,	"	21	4 12	5 12	17	18	17	17	18	22	20	19	17	20	19	11	—	96	119	215	—	1	234	3	1 15	—	(b) 25.2 oz.
		Co. Cork.	"	22	5 5	6 1	8	6	—	1	16	10	14	13	13	12	—	6	77	20	2	99	1	13	223	39	2 5	1	
			"	23	5 8	7 3	5	16	11	4	—	22	21	21	14	12	22	9	42	101	14	157	1	22	348	63	2 2	1	(c) 1,819 Points
			"	24	5 2	5 10	16	15	18	17	15	21	24	16	21	22	13	9	2	108	97	207	—	8	262	24	2 0	2	

(a) Total Eggs from Pen.
(b) Average Weight per dozen.
(c) Scoring Points per Pen.

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—21 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 21–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug 5–Aug 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen (c) Scoring Points per Pen
1	31	Mrs. E. Hillis,	Jan. 26	403	5 4	6 15	1	9	14	14	17	22	26	26	25	20	24	11	4	138	71	213	—	7	347	21	2 0	—	(a) 1,398 Eggs
		Corrush,	,,	404	5 10	8 0	—	14	18	22	24	25	26	24	26	25	25	9	126	105	5	236	6	28	530	81	2 3	—	
		Doohamlet,	,,	405	5 11	7 3	17	21	19	21	23	23	26	20	28	23	21	12	79	162	15	256	—	50	589	150	2 2	—	(b) 26.5 oz.
		Castleblayney,	,,	406	5 4	7 10	8	8	17	18	23	21	21	24	16	13	16	5	36	148	6	190	2	28	425	84	2 2	—	
		Co. Monaghan.	,,	407	6 0	7 7	18	18	17	21	25	25	26	26	22	27	25	12	136	64	2	262	—	51	635	153	2 5	—	(c) 3,607 Points
			,,	408	5 0	6 11	10	20	3	22	25	27	27	27	24	23	26	7	231	10	—	241	—	33	571	99	2 7	—	
2	44	Mr. W. Barron,	Jan. 10	103	5 2	6 11	—	17	20	18	18	17	25	23	23	23	19	11	267	4	—	217	—	37	509	111	2 7	—	(a) 1,202 Eggs
		Woodview,	,,	104	4 12	6 11	18	18	18	19	19	19	23	29	13	21	12	6	175	34	2	211	—	54	511	162	2 5	—	
		Gortrush,	,,	105	6 2	6 13	20	—	16	15	16	22	20	19	12	11	20	6	167	12	1	180	—	36	433	108	2 7	4	(b) 27.9 oz.
		Piltown.	,,	106	6 2	6 13	16	2	4	17	21	17	23	10	21	17	13	11	161	7	1	172	2	22	330	60	2 7	1	
		Co. Kilkenny	,,	107	5 0	6 11	19	21	18	20	21	19	22	17	14	11	14	5	81	114	6	201	45	55	380	159	2 3	—	(c) 2,735 Points
			,,	108	5 2	6 4	14	22	9	7	26	24	24	24	25	23	23	8	156	54	17	227	—	29	503	87	2 4	—	
3	46	Mrs. K. F. Graham,	Feb. 7	115	6 0	6 15	18	11	7	14	19	22	21	23	23	24	25	10	195	25	—	220	1	36	532	104	2 5	—	(a) 1,183 Eggs
		Ballagh Lodge,	,, 14	116	5 3	6 15	22	12	16	19	21	22	23	23	23	19	22	10	83	112	37	232	—	17	458	51	2 2	—	
		Donadea,	March 3	117	5 2	6 12	10	11	13	13	12	8	22	11	21	12	14	5	96	51	6	153	13	31	319	60	2 4	—	(b) 27 1 oz.
		Co Kildare	,,	118	4 15	7 15	12	21	16	19	21	23	24	23	22	10	12	12	197	13	1	216	—	48	513	144	2 6	—	
			Feb. 14	119	5 2	6 5	6	16	14	10	21	17	23	25	26	26	23	11	182	41	—	223	1	36	545	108	2 5	—	(c) 2,690 Points
			,,	120	5 4	7 4	1	8	8	11	12	12	18	19	16	9	13	6	63	75	1	139	1	16	323	45	2 3	—	
4	33	Mrs. D. Heavern,	Feb. 7	49	5 1	7 4	3	15	12	16	19	22	21	22	24	22	20	11	191	14	2	207	1	28	488	81	2 5	—	(a) 1,134 Eggs
		Cortoon,	March 27	50	4 8	6 1	—	—	7	18	19	21	21	25	18	23	23	11	111	75	—	186	—	7	436	21	2 4	—	
		Brownsgrove,	Feb. 7	51	4 8	5 0	—	11	16	11	19	23	22	24	19	18	15	—	36	128	14	178	2	26	383	78	2 2	—	(b) 26.9 oz.
		Tuam,	,,	52	5 0	6 1	7	18	19	15	19	22	22	26	20	21	19	9	198	19	—	217	—	44	527	132	2 5	—	
		Co Galway.	March 27	53	4 8	7 1	—	—	17	20	20	21	23	18	25	19	19	7	145	13	1	189	—	16	437	48	2 5	—	(c) 2,585 Points
			Feb. 7	54	4 8	6 2	—	23	11	5	19	24	21	—	17	10	13	11	10	119	28	157	1	29	311	87	2 1	1	
5	50	Mrs. C. Towey,	Feb. 28	139	5 8	7 8	3	15	16	20	20	20	22	25	22	20	15	5	10	175	19	204	—	26	439	73	2 1	—	(a) 1,151 Eggs
		Silverfield,	,,	140	4 13	6 3	21	15	—	—	6	23	25	25	22	15	24	10	103	80	1	189	—	35	457	105	2 3	—	
		Lisacul,	,,	141	5 0	6 12	12	18	7	16	22	18	21	19	18	18	23	10	141	57	7	205	—	33	450	99	2 4	—	(b) 25.9 oz.
		Ballaghaderreen,	,,	142	5 2	6 10	25	17	16	18	16	19	23	18	9	19	14	5	40	117	42	199	—	17	369	51	2 1	—	
		Co. Roscommon.	,,	143	5 3	7 9	20	19	11	17	21	22	19	23	18	17	14	6	149	55	3	207	—	47	492	141	2 5	—	(c) 2,450 Points
			,,	144	4 9	5 10	4	14	2	—	16	19	24	15	20	10	12	11	—	91	56	147	—	4	207	12	1 15	—	

D = Dead

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec 24–Jan 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
6	51	Mrs. E. M. J. Condron,	Feb. 9	145	4 10	7 8	—	17	20	17	19	17	22	22	24	23	22	11	188	25	1	214	—	36	518	108	2 5	—	(a) 1,015 Eggs
		Knocktemple,	"	146	4 10	7 0	15	17	13	—	16	19	22	23	19	20	22	11	147	50	—	197	1	45	490	135	2 4	—	(b) 27.4 oz.
		Virginia,	"	147	5 0	6 8	—	1	18	16	21	15	22	20	—	9	15	—	123	13	1	137	2	19	308	57	2 6	—	(c) 2,351 Points
		Co. Cavan.	"	148	4 15	6 4	—	8	14	15	21	21	24	23	21	22	19	11	141	57	1	199	—	21	469	63	2 4	—	
			"	149	4 8	D	—	16	10	—	—	19	24	15	D9	—	—	—	14	56	23	93	1	23	161	69	2 1	1	
			"	150	4 8	7 0	—	—	—	15	17	22	22	24	20	23	21	11	150	25	—	175	—	—	105	—	2 5	—	
7	38	Mrs. M. O. Roberts,	March 3	73	6 2	5 8	3	14	5	11	8	20	21	20	11	7	6	1	84	32	6	122	—	16	262	48	2 4	1	(a) 1,015 Eggs
		Lakemount,	"	74	6 2	8 0	19	17	18	18	23	18	23	21	17	19	8	1	160	40	2	202	1	53	479	159	2 5	—	(b) 26.3 oz.
		Glanmire,	Feb. 21	75	5 8	7 15	4	18	10	10	17	22	21	25	22	23	23	8	9	174	27	210	—	24	459	72	2 0	—	(c) 2,282 Points
		Co. Cork.	" 9	76	5 10	6 14	—	—	7	16	18	22	26	22	24	21	21	11	122	66	—	188	—	7	436	21	2 4	—	
			Jan. 31	77	5 12	6 8	—	8	11	12	14	17	18	11	10	10	—	—	94	17	—	111	—	19	251	57	2 5	—	
			March 3	78	6 5	6 8	17	19	10	—	—	20	21	24	22	18	21	10	31	135	16	182	—	34	415	102	2 2	—	
8	37	Mrs. R. B. Eadie,	Jan. 28	67	5 8	7 3	—	8	6	16	21	20	24	25	22	24	20	9	163	27	5	195	—	10	443	30	2 5	—	(a) 1,065 Eggs
		The Poplars,	Feb. 24	68	5 6	4 11	19	15	17	23	20	13	1	—	—	4	7	—	—	24	95	110	1	2	52	6	1 14	—	(b) 26.3 oz.
		Beaufort,	Jan. 28	69	5 3	5 13	—	6	17	12	16	22	22	25	19	18	16	11	109	73	2	184	2	28	425	60	2 4	—	(c) 2,221 Points
		Co. Kerry.	Feb 4	70	5 0	7 3	—	—	5	18	21	28	26	22	23	23	19	11	16	167	8	191	—	3	420	9	2 2	—	
			" 24	71	5 14	6 15	12	20	20	20	22	6	21	2	18	12	7	3	77	82	4	163	2	50	383	147	2 3	2	
			"	72	5 14	6 7	3	17	15	16	21	20	23	24	23	23	18	10	159	50	4	213	1	31	498	93	2 5	—	
9	47	Miss M. O'Keeffe,	March 22	121	5 11	7 2	—	—	—	9	20	21	20	19	17	18	17	11	21	120	11	152	—	—	323	—	2 2	—	(a) 989 Eggs
		Ballybooden,	"	122	4 12	6 11	1	16	7	18	18	17	24	27	18	4	14	8	146	25	1	172	—	23	391	69	2 6	—	(b) 27.0 oz.
		Knocktopher,	"	123	5 0	6 15	—	—	—	18	26	23	25	15	27	16	13	8	70	93	2	171	—	—	375	—	2 3	—	(c) 2,171 Points
		Co. Kilkenny.	"	124	4 8	8 7	—	7	14	16	18	18	19	19	8	—	—	1	36	54	30	120	—	1	182	3	2 2	—	
			"	125	5 8	7 2	10	12	12	14	7	17	24	22	26	26	21	12	195	8	—	203	1	34	497	102	2 7	—	
			"	126	5 8	7 7	11	20	—	—	11	22	22	21	16	18	19	11	70	94	7	171	1	24	398	72	2 3	—	
10	40	Mrs. W. Coleman,	Feb. 15	85	4 12	7 2	12	21	22	20	22	23	26	21	23	19	16	8	1	66	166	233	1	3	168	9	1 15	—	(a) 1,228 Eggs
		Banada,	"	86	4 9	7 5	16	20	19	18	20	25	27	27	25	23	19	11	13	177	60	250	—	17	447	51	2 0	—	(b) 25.5 oz.
		Ballaghaderreen,	"	87	4 10	D	6	16	16	14	22	21	20	19	17	D2	—	—	115	37	1	153	—	37	343	111	2 6	—	(c) 2,164 Points
		Co. Roscommon.	"	88	4 14	6 15	19	7	14	20	19	24	25	11	21	10	15	6	3	122	69	194	—	3	282	9	2 0	2	
			"	89	4 9	6 14	15	12	4	9	5	25	27	28	19	23	16	10	16	164	13	193	1	26	433	78	2 2	—	
			"	90	4 15	8 7	—	15	18	19	19	21	22	22	19	22	18	10	190	14	1	205	—	33	491	99	2 7	—	

D = Dead

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight On Arrival lb. oz.	Weight At Close of Test lb. oz.	Eggs Laid Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
11	45	Mrs. B. Martin,	Feb. 1	109	4 8	5 10	18	11	11	—	18	22	25	19	14	16	17	11	18	131	33	182	3	26	361	78	2 1	2	(a) 1,142 Eggs
		Corglass,	"	110	4 10	6 0	3	18	14	17	18	19	24	23	23	19	18	7	178	22	3	203	—	32	476	96	2 5	—	
		Kingscourt,	"	111	4 9	5 10	8	18	18	19	17	19	23	18	20	11	9	10	45	137	8	190	—	41	435	123	2 2	1	(b) 25.1 oz.
		Co. Cavan.	"	112	5 0	6 10	15	10	—	9	21	14	22	13	19	11	20	10	8	92	64	164	—	9	245	27	2 0	1	
			Feb. 7	113	4 8	7 2	2	20	21	1	16	6	20	16	15	11	10	7	6	98	41	145	—	12	245	36	2 0	1	(c) 2,143 Points
			"	114	4 12	6 15	14	20	18	19	21	23	26	28	27	25	25	12	1	160	97	258	—	2	381	6	1 15	—	
12	48	Miss B. Quain,	Feb. 20	127	4 10	6 8	5	21	14	17	16	16	25	17	18	11	5	8	89	72	12	173	1	32	376	96	2 3	1	(a) 967 Eggs
		Anglesboro',	"	128	5 0	7 2	—	12	15	19	19	22	18	19	16	9	15	11	108	66	1	175	1	27	408	81	2 4	—	
		Co. Limerick,	"	129	4 9	6 12	—	—	14	—	10	20	14	7	17	13	7	4	2	92	12	106	4	11	210	33	2 1	1	(b) 27.0 oz.
		via Mitchelstown.	"	130	6 3	6 7	21	17	13	5	11	23	12	21	18	18	10	12	24	117	40	181	2	35	347	105	2 1	2	
			"	131	4 8	7 3	—	4	12	13	15	18	15	22	21	19	19	10	162	6	—	168	—	16	400	48	2 10	—	(c) 2,117 Points
			"	132	5 0	7 0	—	—	2	13	19	21	23	17	23	18	16	10	127	37	—	164	—	2	376	6	2 5	—	
13	43	Mrs. J. Scally,	March 10	97	5 10	8 3	3	20	21	20	17	21	13	5	3	8	9	3	80	57	6	143	—	39	333	117	2 4	—	(a) 1,052 Eggs
		Ballyteague,	"	98	5 0	6 8	—	16	19	21	20	21	20	20	16	11	—	—	14	140	10	164	—	25	344	75	2 2	—	
		Ballycommon,	"	99	5 8	6 9	—	9	22	20	21	21	22	17	6	1	—	—	98	40	1	139	18	30	271	90	2 4	—	(b) 25.4 oz.
		Daingean,	"	100	4 10	5 13	19	20	19	18	17	17	18	14	11	11	2	—	51	97	18	166	—	42	351	126	2 2	—	
		Offaly.	"	101	5 2	5 11	23	19	20	18	21	20	23	13	18	22	9	10	35	130	51	216	—	21	392	63	2 1	1	(c) 2,115 Points
			"	102	5 8	7 4	23	18	17	20	20	17	23	23	19	10	22	12	4	171	49	224	—	31	424	93	2 0	—	
14	35	Mrs. T. Kelly,	Feb. 4	61	4 12	6 10	—	12	16	19	21	20	22	18	18	17	20	9	110	80	2	192	—	26	452	78	2 4	—	(a) 929 Eggs
		Ballyskea,	"	62	4 8	6 11	—	16	15	16	21	10	16	13	8	8	—	—	106	16	1	123	1	31	280	90	2 6	—	
		Monivea,	"	63	4 12	6 3	1	17	13	16	18	17	20	18	11	12	5	2	12	123	15	150	1	30	319	90	2 1	—	(b) 26.5 oz.
		Co. Galway.	"	64	5 2	D	21	18	18	13	20	14	16	18	5	—	D	—	66	71	6	143	4	56	321	165	2 3	—	
			"	65	4 8	6 8	3	17	16	17	21	17	18	21	17	11	8	5	116	49	6	171	1	31	385	93	2 5	—	(c) 2,098 Points
			"	66	4 13	6 0	9	8	14	12	16	14	16	16	17	13	8	7	41	103	6	150	—	27	343	81	2 3	—	
15	39	Mrs. M. Connolly,	February	79	5 6	D	17	D	—	—	—	—	—	—	—	—	—	—	1	11	5	17	—	12	36	36	2 0	—	(a) 904 Eggs
		Carrigamore,	"	80	4 12	7 7	20	18	9	—	1	23	17	26	22	22	23	10	143	48	—	191	1	47	482	141	2 4	—	
		Corvalley P.O.	"	81	5 0	7 11	17	18	16	15	20	21	20	22	10	—	—	—	62	97	—	159	1	51	367	153	2 3	—	(b) 26.1 oz.
		Co. Monaghan.	"	82	5 4	8 8	—	—	24	25	22	12	23	14	8	8	—	—	64	64	8	136	—	22	286	66	2 3	—	
			"	83	5 2	6 2	20	21	20	22	19	21	16	12	18	—	7	—	124	52	—	176	1	61	418	183	2 4	—	(c) 2,009 Points
			"	84	5 0	6 12	18	22	18	20	19	18	20	18	19	22	19	12	10	186	29	225	31	44	420	132	2 1	—	

D = Dead

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival (lb. oz)	Weight: At Close of Test (lb. oz)	Eggs Laid: Oct. 1–Oct. 28	Oct 29–Nov. 25	Nov. 26–Dec 23	Dec. 24–Jan. 20	Jan 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen (c) Scoring Points per Pen
16	52	Mrs E. Kennedy,	Feb. 6	151	4 15	6 2	18	20	14	18	18	17	23	24	19	23	24	9	—	17	210	227	—	—	46	—	1 13	—	(a) 1,070 Eggs
		Ballyroe,	”	152	5 0	6 0	13	13	12	20	19	19	20	11	21	20	16	8	58	106	28	192	—	29	401	87	2 2	1	(b) 26.5 oz.
		Freshford,	”	153	5 0	6 4	14	15	18	14	19	18	24	24	22	20	22	9	218	1	—	219	—	47	536	141	2 7	—	(c) 1,942 Points
		Co. Kilkenny.	”	154	4 8	5 0	10	12	11	—	18	17	11	17	24	15	—	9	38	82	24	144	1	31	281	93	2 1	—	
			”	155	5 8	5 15	16	14	12	14	14	14	19	20	16	19	6	3	156	9	2	167	—	42	400	126	2 8	—	
			”	156	5 2	7 2	13	15	14	12	14	21	22	10	—	—	—	—	109	12	—	121	2	42	278	120	2 5	—	
17	32	Mrs. M. Gammons,	Feb. 24	43	5 12	6 11	21	17	20	22	22	23	24	26	23	13	18	4	102	119	12	233	—	51	526	153	2 3	1	(a) 922 Eggs
		Ladyrath,	”	44	5 2	7 3	—	15	12	—	8	23	23	21	18	18	20	10	15	126	27	168	—	12	336	36	2 1	—	(b) 25.3 oz.
		Wilkinstown,	”	45	6 0	6 10	16	13	19	6	11	21	13	14	21	11	16	3	74	66	29	169	—	22	331	66	2 2	3	(c) 1,644 Points
		Navan,	”	46	5 4	D	12	8	24	21	26	11	19	26	18	—	D	—	5	46	114	165	—	2	104	6	1 14	—	
		Co. Meath.	”	47	6 8	9 11	15	12	1	14	21	2	13	16	8	9	6	3	79	25	16	120	16	12	199	27	2 4	—	
			”	48	5 0	D	1	19	8	—	14	10	15	D	—	—	—	—	27	35	5	67	—	24	148	72	2 2	—	
18	34	Mrs. M. F. Bailey,	Feb. 7	55	4 8	5 1	—	—	—	—	—	—	11	22	22	22	19	4	1	73	26	100	—	—	187	—	2 0	—	(a) 700 Eggs
		Shanavaughy,	”	56	6 0	7 11	16	14	16	20	21	26	20	26	19	20	19	6	60	155	8	223	2	42	508	123	2 2	—	(b) 26.1 oz.
		Ballacolla,	”	57	4 8	5 10	18	—	—	—	—	—	—	—	—	—	—	—	14	3	1	18	—	17	51	51	2 3	—	(c) 1,619 Points
		Laoighis.	”	58	4 12	6 3	2	9	19	14	2	22	22	25	21	7	21	11	98	77	—	175	—	30	419	90	2 4	1	
			”	59	5 0	6 7	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	1	—	1	3	3	2 4	—	
			”	60	4 10	5 9	9	16	17	11	8	19	19	18	20	18	18	10	140	42	1	183	—	41	451	123	2 4	—	
19	49	Mrs. J. O'Connell,	March 16	133	4 8	7 8	—	9	17	16	—	2	—	—	—	—	—	—	5	31	8	44	—	19	91	57	2 1	—	(a) 744 Eggs
		Athgoe,	”	134	4 10	D	20	—	7	18	19	D7	—	—	—	—	—	—	—	16	55	71	1	2	32	6	1 14	—	(b) 25.3 oz.
		Straffan P.O.,	”	135	4 8	5 9	5	7	6	20	18	9	20	24	21	20	16	9	105	61	9	175	2	9	382	27	2 3	—	(c) 1,493 Points
		(Co. Dublin).	”	136	4 12	6 8	9	11	1	13	22	20	24	20	21	19	8	11	63	99	12	179	—	12	383	36	2 2	—	
			”	137	4 8	D	—	8	12	11	13	D11	—	—	—	—	—	—	3	47	5	55	—	19	119	57	2 1	—	
			”	138	4 8	6 11	—	15	17	13	17	27	26	26	23	22	22	12	2	203	15	220	—	22	486	66	2 1	—	
20	41	Mrs. L. O'Reilly,	Feb. 28	91	5 8	6 4	—	9	20	9	—	—	—	—	—	—	—	—	1	26	11	38	—	22	76	66	2 0	—	(a) 647 Eggs
		Rodstown,	”	92	5 12	6 11	14	15	14	20	21	16	4	—	—	—	—	—	21	61	22	101	—	26	190	78	2 1	—	(b) 24.5 oz.
		Balrath,	”	93	4 10	4 8	—	9	13	—	—	—	—	—	—	7	20	12	—	26	35	61	—	7	78	21	1 15	—	(c) 1,164 Points
		Ceanannus Mor,	”	94	5 0	5 8	—	17	14	11	20	17	23	24	22	8	3	2	—	111	50	161	1	8	240	24	2 0	—	
		Co. Meath.	”	95	4 12	6 15	—	—	11	11	17	16	21	15	10	10	12	3	43	77	11	131	—	8	278	24	2 2	2	
			”	96	4 8	4 13	11	11	17	18	18	14	19	19	—	13	11	1	7	121	24	152	—	21	302	63	2 1	1	

D = Dead

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen
21	30	Mrs. J. Fahy,	Jan. 2	1	4 8	6 0	5	12	14	14	14	20	13	7	4	—	—	—	39	60	4	103	1	29	225	87	2 3	—	(a) 540 Eggs
		Corbally,	,,	2	5 4	5 10	—	—	—	—	—	4	7	2	—	—	—	—	—	13	—	13	—	—	26	—	2 3	—	
		Ballyglunin,	Jan. 8	3	5 0	5 12	13	14	11	14	19	19	17	—	—	—	—	—	—	73	34	107	—	25	171	75	2 0	—	(b) 25.0 oz.
		Co. Galway.	,, 28	4	4 8	4 11	7	11	12	13	17	19	23	21	15	17	12	5	26	119	27	172	1	10	332	30	2 1	—	
			,, ,,	5	5 0	5 0	5	14	8	10	17	8	9	2	—	—	—	—	19	53	1	73	—	26	170	78	2 2	—	(c) 1.048 Points
			,, 2	6	4 8	D	—	—	—	—	8	24	23	16	D 1	—	—	—	1	62	9	72	1	—	124	—	2 1	—	

D = Dead

SECTION III.—RHODE ISLAND RED—19 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
1	53	Mrs. K. Sammon,	Feb. 18	157	5 8	7 0	12	21	22	18	19	20	21	21	23	22	19	8	59	166	1	226	2	55	548	159	2 3	—	(a) 1,176 Eggs
		Carrigahorig,	"	158	5 3	6 4	21	20	3	—	14	17	19	18	17	18	16	—	115	48	—	163	2	41	400	132	2 2	1	
		Lorrha,	"	159	5 10	7 15	—	15	19	20	19	20	22	25	24	19	19	10	65	145	2	212	—	33	501	90	2 3	—	(b) 26.8 oz.
		Birr,	"	160	5 2	8 6	—	6	10	20	21	21	23	24	7	17	8	8	34	134	6	174	—	21	392	72	2 2	2	
		Offaly.	"	161	5 8	7 3	12	21	20	22	24	22	23	24	18	19	16	8	198	31	—	220	—	53	554	159	2 5	—	(c) 2,783 Points
			"	162	5 2	8 3	—	10	10	23	18	19	23	24	19	20	6	—	165	7	—	172	1	20	388	60	2 7	—	
2	68	Mr. M. Fitzgibbon,	Feb. 20	241	5 10	7 4	12	2	5	13	10	13	14	18	15	14	12	5	99	34	—	133	26	19	255	54	2 4	—	(a) 1,221 Eggs
		Gurrane,	"	242	6 0	6 12	6	10	23	21	15	19	26	26	23	26	18	8	88	132	1	221	—	39	531	117	2 3	—	
		Kilmeedy,	"	243	5 8	6 11	13	14	—	16	20	24	23	25	20	25	20	11	194	20	—	214	—	27	511	81	2 5	—	(b) 26.8 oz.
		Co. Limerick.	"	244	5 9	7 1	20	13	18	18	9	16	25	26	22	24	22	8	44	173	4	221	—	49	537	147	2 2	—	
			"	245	5 6	6 11	—	9	23	19	24	21	26	25	22	22	2	11	126	76	2	204	—	31	470	93	2 4	—	(c) 2,710 Points
			"	246	5 2	6 11	16	21	16	29	25	22	20	18	18	23	19	10	14	148	66	228	—	34	406	102	2 0	—	
3	63	Mr. W. Murphy,	Feb. 23	211	6 0	8 0	5	24	23	24	23	26	25	23	18	14	15	7	218	9	—	227	1	52	540	156	2 7	1	(a) 1,132 Eggs
		Skeeter Park,	"	212	5 8	5 8	20	20	13	18	20	20	22	19	13	17	5	—	129	56	7	192	—	51	443	153	2 4	—	
		Cleariestown,	" 4	213	6 0	9 11	5	21	16	10	18	12	23	20	12	11	—	—	111	32	5	148	2	39	332	117	2 4	1	(b) 27.5 oz.
		Co. Wexford.	" "	214	6 2	7 10	24	22	21	19	23	23	24	16	18	14	18	7	166	61	2	229	2	66	555	198	2 4	—	
			" 23	215	5 4	6 3	16	19	18	19	15	—	12	22	17	5	12	1	93	60	3	156	—	52	375	156	2 3	1	(c) 2,652 Points
			" 4	216	5 0	7 9	—	—	9	21	22	22	25	26	17	19	15	4	146	34	—	180	—	9	407	27	2 5	—	
4	65	Mrs. A. M. Lynch,	Feb. 28	223	5 0	6 2	20	14	4	10	13	22	23	20	16	16	11	3	101	61	10	172	—	30	384	90	2 3	—	(a) 1,193 Eggs
		Athgoe Villa,	"	224	4 8	6 1	—	9	22	3	16	24	24	24	16	21	15	9	22	118	43	183	1	28	338	84	2 1	3	
		Straffan,	"	225	4 8	6 4	4	12	18	20	20	22	26	20	20	16	14	8	63	135	2	200	—	34	468	102	2 3	—	(b) 26 2 oz.
		(Co. Dublin).	"	226	4 14	5 14	—	1	20	17	21	24	28	26	24	4	20	5	135	52	3	190	—	21	421	63	2 5	2	
			"	227	4 12	7 2	—	19	20	19	21	23	22	26	23	21	17	9	34	150	36	220	7	38	418	114	2 1	—	(c) 2,573 Points
			"	228	4 8	6 10	—	7	19	17	20	24	27	28	27	25	26	8	179	49	—	228	—	26	541	78	2 5	—	
5	55	Mr. D. H. Edwards,	Feb. 24	169	5 4	7 9	—	17	20	8	—	9	21	26	25	24	22	11	29	147	10	186	—	30	438	90	2 2	—	(a) 1,096 Eggs
		Drumgowan,	March 9	170	5 12	7 8	14	—	—	17	19	23	26	26	23	22	21	11	142	56	4	202	1	10	458	30	2 4	—	
		Burt,	"	171	5 4	7 10	3	18	21	21	17	20	23	25	18	13	17	—	63	124	9	196	1	40	439	117	2 3	2	(b) 25.7 oz.
		Co. Donegal.	Feb. 24	172	5 12	6 14	—	—	13	25	22	22	23	24	12	15	9	13	77	96	5	178	—	12	395	36	2 3	—	
			"	173	4 13	5 12	23	13	—	17	11	3	19	9	23	23	24	8	4	110	59	173	—	9	276	27	2 0	—	(c) 2,350 Points
			"	174	5 6	6 14	—	—	2	17	15	19	20	23	20	16	20	9	10	142	9	161	—	2	344	6	2 2	—	

SECTION III.—RHODE ISLAND RED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct 1–Dec 23	Scoring Points per Bird: Full Period	Oct 1–Dec 23	Average Weight of Eggs per Bird (oz. dr)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
6	59	Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.	March	187	4 8	D	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(a) 1,161 Eggs
			,,	188	5 0	8 6	—	21	8	8	25	24	26	26	28	25	20	11	192	23	2	222	1	28	521	84	2 5	—	(b) 25 8 oz.
			,,	189	4 10	6 14	1	22	20	20	25	20	25	22	25	23	21	9	20	203	10	232	2	36	529	108	2 1	—	(c) 2,339 Points
			,,	190	4 8	7 6	3	24	22	21	21	22	26	21	22	19	22	9	131	95	3	232	—	46	554	138	2 3	—	
			,,	191	5 0	7 8	17	23	19	17	22	18	24	22	25	23	26	11	151	67	2	250	—	57	613	171	2 4	—	
			,,	192	4 9	7 8	2	22	23	25	23	21	25	21	18	23	11	9	2	43	179	224	—	11	122	33	1 15	—	
7	58	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	Feb. 10	181	4 8	5 15	15	4	1	18	—	17	24	25	27	22	25	11	—	71	121	192	—	3	171	9	1 15	—	(a) 1,170 Eggs
			,,	182	5 2	6 2	21	17	17	17	20	23	25	25	19	22	18	8	12	184	6	232	4	54	543	159	2 2	—	(b) 25.1 oz.
			,,	183	4 10	4 11	20	16	18	18	19	21	19	18	19	11	11	—	20	156	20	196	1	44	419	132	2 1	—	(c) 2,261 Points
			,,	184	5 2	6 15	1	18	18	19	16	24	23	20	21	18	15	9	128	73	1	202	3	37	475	111	2 4	—	
			,,	185	5 2	7 6	11	20	19	16	19	22	20	22	23	21	21	8	10	140	62	222	—	19	382	57	2 0	—	
			,,	186	5 6	D	13	15	11	15	15	21	15	17	D	—	—	—	41	79	3	126	5	37	271	105	2 3	—	
8	66	Mrs. K. Earl, Grantstown House, Waterford.	March 7	229	4 10	D	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(a) 979 Eggs
			,,	230	5 3	5 15	7	13	14	18	20	23	21	25	22	25	24	10	41	169	15	228	5	34	506	102	2 2	—	(b) 26.9 oz.
			,,	231	4 10	7 8	—	2	22	20	21	21	25	22	21	22	21	7	14	182	8	204	2	23	460	69	2 2	—	(c) 2,249 Points
			,,	232	4 12	7 8	—	—	9	18	20	19	24	23	8	22	10	9	158	4	—	162	—	9	371	27	2 8	1	
			,,	233	4 6	6 15	—	16	21	17	22	21	19	22	17	16	18	7	160	56	—	196	1	37	468	111	2 4	—	
			,,	234	4 8	5 15	—	—	14	19	18	20	23	26	16	21	22	16	162	27	—	189	2	14	441	42	2 4	—	
9	67	Mrs. K. Cuddihy, Hillside P.F., Glenmore, Co. Kilkenny.	March	235	6 8	7 10	2	—	3	—	—	11	22	20	18	16	20	8	16	93	11	120	—	2	261	6	2 2	—	(a) 974 Eggs
			,,	236	6 8	7 8	—	—	14	19	19	22	23	25	25	23	21	9	95	100	3	198	—	11	454	33	2 3	—	(b) 26.8 oz.
			,,	237	6 8	10 1	11	2	12	15	18	10	22	18	6	1	—	6	54	61	12	130	—	19	262	57	2 3	—	(c) 2,195 Points
			,,	238	6 9	8 7	—	13	9	16	16	24	21	24	25	2	21	11	116	63	3	182	2	21	407	57	2 6	1	
			,,	239	6 6	7 8	8	7	6	11	19	17	19	11	18	21	24	9	110	55	5	170	3	18	394	51	2 5	—	
			,,	240	6 0	7 8	—	—	16	10	15	—	20	26	26	26	23	12	70	101	3	174	—	14	417	42	2 3	—	
10	64	Mrs. K. Cuddihy, Hillside P.F., Glenmore, Co. Kilkenny.	March	217	5 10	7 0	9	12	13	17	18	20	27	22	24	23	18	9	111	95	6	212	—	31	493	93	2 3	—	(a) 897 Eggs
			,,	218	6 4	8 3	2	17	14	20	18	20	19	9	14	17	15	1	132	32	5	169	—	31	395	93	2 5	—	(b) 27.7 oz.
			,,	219	6 0	8 7	—	—	2	4	16	21	21	18	18	18	18	5	123	18	—	141	—	2	325	6	2 5	—	(c) 2,097 Points
			,,	220	5 10	7 12	—	17	18	7	—	11	20	24	20	19	20	11	119	18	—	167	1	35	417	105	2 6	—	
			,,	221	5 12	8 8	4	9	5	—	8	3	6	1	3	—	1	1	5	27	9	41	1	11	75	33	2 1	—	
			,,	222	5 5	7 1	—	1	13	15	17	19	19	21	18	17	21	6	159	8	—	167	—	14	392	42	2 7	—	

D = Dead

SECTION III.—RHODE ISLAND RED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen (c) Scoring Points per Pen.
11	72	Mrs. N. O'Sullivan, Hill View, Bandon, Co. Cork.	Jan. 11	259	5 2	3 8	17	10	9	15	11	22	25	23	21	—	—	—	81	70	—	151	1	36	336	108	2 3	—	(a) 1,269 Eggs
			,, ,,	260	5 9	6 11	9	11	15	17	26	21	24	22	21	20	19	7	—	63	143	206	—	1	151	5	1 15	—	
			Feb. 4	261	5 6	6 9	14	14	12	18	22	21	25	24	21	21	20	8	54	156	13	223	—	33	502	96	2 2	—	(b) 24.3 oz.
			,, ,,	262	5 6	5 9	11	15	16	11	19	25	24	25	23	21	19	12	6	189	27	222	—	29	470	87	2 1	—	
			,, 20	263	5 8	5 12	16	14	12	19	19	23	23	26	26	27	23	9	9	205	26	240	—	26	506	78	2 1	—	(c) 1,990 Points
			,, 26	264	4 10	6 2	—	—	18	17	24	25	26	27	26	25	25	14	—	12	215	227	—	—	25	—	1 13	—	
12	62	Miss M. Keane, Killurin, Wexford.	Feb. 26	205	5 10	9 0	16	19	20	16	15	16	21	23	17	17	15	7	157	44	1	202	—	54	495	162	2 5	—	(a) 1,206 Eggs
			,,	206	4 8	5 2	—	15	18	18	22	21	25	25	21	6	15	2	2	99	87	188	—	15	233	45	2 0	2	
			,,	207	5 13	6 2	15	22	17	18	17	19	27	26	21	24	23	12	1	25	215	241	—	8	61	24	1 13	—	(b) 24.7 oz.
			,,	208	5 0	7 2	5	18	18	10	—	[illegible]	23	25	26	24	21	13	16	159	15	190	—	28	436	84	2 1	—	
			,,	209	5 14	7 8	—	13	18	20	21	17	22	18	13	22	10	7	70	96	15	181	1	21	389	63	2 3	—	(c) 1,988 Points
			,,	210	4 14	6 6	12	17	16	14	—	24	27	25	18	24	24	7	13	140	51	204	—	26	374	78	2 0	—	
13	73	Mrs. M. Horish, Corballis, Donabate, Co. Dublin.	March 4	265	6 0	6 12	19	19	13	19	20	16	22	19	25	21	9	6	80	115	13	208	—	43	469	129	2 2	—	(a) 1,243 Eggs
			,, ,,	266	5 12	5 12	25	24	22	19	23	25	24	21	23	16	8	6	9	166	65	240	—	38	418	114	2 0	1	
			,, 17	267	5 12	7 4	—	—	6	18	20	9	27	26	26	20	6	—	2	100	56	158	1	4	218	12	2 0	—	(b) 24 2 oz.
			,, 4	268	5 4	6 12	9	17	—	15	22	5	26	23	14	17	9	13	85	83	2	170	—	26	401	78	2 3	1	
			,, ,,	269	5 0	7 3	—	11	22	20	20	21	27	26	26	23	22	12	—	7	224	231	—	1	16	3	1 13	—	(c) 1,900 Points
			,, 17	270	5 0	6 4	20	20	17	20	18	22	25	21	22	20	20	11	6	152	78	236	—	41	378	123	2 0	—	
14	60	Mrs. M. A. Miller, Mill View, Lenamore, Rathowen, (Co. Longford).	February	193	5 12	7 0	12	—	—	11	10	17	20	21	23	19	19	6	155	2	1	158	—	11	369	33	2 7	—	(a) 874 Eggs
			,,	194	5 0	7 0	6	19	19	20	20	21	25	24	20	13	7	8	36	158	7	201	—	41	457	123	2 2	1	
			,,	195	4 8	6 0	—	15	20	21	21	22	22	24	18	18	21	10	13	167	31	211	2	27	427	81	2 1	—	(b) 25.7 oz.
			,,	196	4 8	5 3	4	19	18	21	21	20	17	3	—	—	—	—	2	59	62	123	—	20	142	60	1 15	—	
			,,	197	4 8	D	14	7	—	1	13	17	14	D4	—	—	—	—	10	55	6	71	—	20	150	60	2 1	—	(c) 1,801 Points
			,,	198	5 0	6 2	14	9	13	9	3	15	15	12	14	6	—	—	44	64	2	110	—	34	256	102	2 3	—	
15	61	Mrs. C. Healy, Clonmeen, Banteer, Co. Cork.	Feb. 10	199	5 4	7 2	—	4	17	19	23	23	22	22	20	16	13	8	8	162	17	187	—	19	392	57	2 1	—	(a) 1,027 Eggs
			,,	200	5 4	6 14	—	10	22	7	20	25	14	14	15	18	13	—	1	20	135	156	—	10	56	30	1 14	3	
			,,	201	5 8	7 5	13	12	6	19	21	7	21	13	14	15	11	4	—	39	117	156	—	—	86	—	1 14	2	(b) 24.9 oz.
			,,	202	5 4	5 9	—	—	—	16	22	20	17	18	—	10	10	—	20	87	6	113	3	—	228	—	2 2	—	
			,,	203	5 0	7 9	10	19	11	13	18	16	22	19	19	18	18	7	140	47	3	190	—	40	457	120	2 4	—	(c) 1,744 Points
			,,	204	5 8	7 15	4	21	22	20	22	21	22	24	21	19	20	9	94	123	8	225	—	43	525	129	2 3	—	

D=Dead

SECTION III.—RHODE ISLAND RED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov 26–Dec. 23	Dec. 24–Jan 20	Jan 21–Feb. 17	Feb. 18–Mar. 17	Mar 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug 4	Aug. 5–Aug 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
16	54	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.	March 20	163	5 8	6 8	—	—	18	25	20	—	23	23	23	26	15	—	66	102	7	175	1	17	392	51	2 3	—	(a) 843 Eggs
			,,	164	5 0	6 14	—	7	23	21	21	20	23	22	21	12	15	—	18	158	9	185	2	30	405	90	2 1	1	(b) 25.0 oz.
			,,	165	5 4	6 0	19	3	—	1	19	24	25	23	25	22	14	11	15	138	33	186	1	21	355	63	2 1	—	(c) 1,738 Points
			,,	166	5 0	D	4	19	24	13	—	—	D	—	—	—	—	—	1	45	14	60	—	39	131	117	2 0	—	
			,,	167	4 12	D	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
			,,	168	5 6	6 0	23	24	23	21	20	27	24	20	21	19	11	4	26	163	48	237	—	39	450	117	2 1	1	
17	70	Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.	March	253	4 8	5 15	—	—	8	21	19	23	22	22	22	22	17	10	147	38	1	183	—	7	426	21	2 4	—	(a) 1,047 Eggs
			,,	254	5 2	5 11	18	21	21	22	19	14	16	15	13	7	11	8	3	55	127	185	43	3	33	9	1 14	—	(b) 25.9 oz.
			,,	255	4 8	7 3	19	17	16	18	11	16	17	14	17	14	16	6	6	135	40	181	2	24	337	72	2 0	—	(c) 1,721 Points
			,,	256	5 3	5 12	19	23	19	19	13	6	15	10	5	5	4	1	2	75	62	139	42	18	88	51	2 0	—	
			,,	257	4 14	7 0	10	18	12	—	18	22	28	25	19	21	15	0	188	11	—	197	3	40	471	117	2 7	—	
			,,	258	4 8	6 15	—	—	4	22	16	3	25	24	21	10	22	12	141	18	—	159	—	4	366	12	2 5	—	
18	56	Miss V. Burdon, The Laurels, Buttevant, Co. Cork.	March 5	175	5 0	5 12	12	20	22	20	19	13	23	23	22	16	16	1	—	112	95	207	—	10	246	30	2 0	—	(a) 928 Eggs
			,,	176	5 4	6 11	14	17	17	19	16	19	22	19	11	18	13	7	—	125	67	192	1	13	298	39	2 0	—	(b) 25.4 oz.
			,,	177	5 8	6 15	—	—	—	3	4	17	2	15	17	6	17	10	89	2	—	91	1	—	212	—	2 8	1	(c) 1,683 Points
			,,	178	5 4	6 15	9	—	—	13	18	17	23	15	22	14	12	7	81	58	8	150	—	3	320	9	2 3	—	
			,,	179	5 0	5 11	—	—	—	5	11	13	23	25	23	23	12	3	4	111	20	138	—	—	270	—	2 1	1	
			,,	180	5 4	6 12	—	—	2	17	12	20	22	18	20	17	15	7	109	39	2	150	—	2	337	6	2 4	—	
19	69	Capt. H. M. S. Redmond, Popefield, Athy, (Laoighis).	—	247	5 0	5 12	17	11	12	—	3	25	25	22	23	9	4	12	4	132	33	169	—	28	322	84	2 0	—	(a) 790 Eggs
			—	248	4 8	D	—	—	7	14	18	17	20	D5	—	—	—	—	—	57	24	81	—	5	119	15	2 0	—	(b) 24.6 oz.
			—	249	4 8	D	11	18	12	1	18	24	19	20	21	4	D	—	—	25	123	148	—	5	55	15	1 14	—	(c) 1,275 Points
			—	250	4 12	6 6	—	2	22	15	19	20	21	22	24	21	17	11	4	135	58	197	—	20	322	60	2 0	—	
			—	251	4 15	6 0	—	—	12	17	22	19	25	21	23	22	22	9	149	43	—	192	—	12	449	36	2 4	—	
			—	252	5 10	D	—	—	2	1	—	—	—	D	—	—	—	—	2	1	—	3	—	2	8	6	2 5	—	

D = Dead

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS) 16 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Eggs Laid: Oct. 29–Nov. 25	Eggs Laid: Nov. 26–Dec. 23	Eggs Laid: Dec. 21–Jan. 20	Eggs Laid: Jan. 21–Feb. 17	Eggs Laid: Feb. 18–Mar. 17	Eggs Laid: Mar. 18–Apl. 14	Eggs Laid: Apl. 15–May 12	Eggs Laid: May 13–June 9	Eggs Laid: June 10–July 7	Eggs Laid: July 8–Aug. 4	Eggs Laid: Aug. 5–Aug. 18	Eggs per Bird: Special Grade	Eggs per Bird: First Grade	Eggs per Bird: Under First Grade	Eggs per Bird: Total	Eggs per Bird: Defective Special and First Grade	Eggs per Bird: Special and First Grade—Oct. 1–Dec. 22	Scoring Points per Bird: Full Period	Scoring Points per Bird: Oct. 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
1	80	Miss M. O'Donovan,	Feb. 10	307	5 8	6 15	8	20	13	18	23	18	26	25	27	24	22	10	199	33	2	234	—	40	560	120	2 5	—	(a) 1,274 Eggs
		Dromore,	,,	308	5 3	6 10	20	15	—	14	24	24	27	26	24	24	15	8	23	180	18	221	4	29	473	87	2 1	1	
		Villierstown,	,,	309	4 9	D	21	21	19	18	20	—	22	24	26	7	D	—	22	116	10	178	—	55	396	165	2 1	—	(b) 25.8 oz.
		Cappoquin,	,,	310	5 8	6 12	17	16	16	17	18	10	23	23	23	22	21	8	108	103	3	214	—	48	521	144	2 3	—	
		Co. Waterford.	,,	311	5 8	D	23	21	21	21	22	9	28	26	25	D13	—	—	34	148	27	209	—	44	420	132	2 1	—	(c) 2,838 Points
			,,	312	4 10	6 15	8	13	13	19	22	23	22	24	25	25	13	11	51	149	18	218	1	34	468	102	2 2	1	
2	76	Miss C. Mealiff,	Feb. 20	283	5 8	6 15	5	8	6	10	9	19	22	17	20	20	20	8	157	7	—	164	—	19	395	57	2 8	—	(a) 1,146 Eggs
		Ballinamona House,	,,	284	5 0	6 5	7	19	15	16	18	22	22	22	22	23	22	9	65	150	2	217	5	41	513	120	2 3	—	
		Tullamore,	,,	285	4 12	6 11	13	20	16	21	—	9	25	24	24	24	21	9	34	167	5	206	—	46	501	138	2 2	—	(b) 27.2 oz.
		Offaly.	,,	286	6 8	7 6	6	19	19	16	21	20	22	20	20	18	15	4	190	9	1	200	—	43	478	129	2 5	—	
			March 6	287	5 5	6 15	—	15	14	12	19	20	25	24	21	16	19	6	156	33	—	189	—	29	448	87	2 5	—	(c) 2,722 Points
			,,	288	5 8	7 15	—	10	20	19	22	20	23	18	18	16	3	1	130	39	1	170	—	29	387	57	2 4	—	
3	82	Mrs. E. Hammersley,	Feb. 13	319	4 9	6 6	—	2	18	18	21	17	26	25	23	25	23	10	83	122	3	208	—	20	487	60	2 3	—	(a) 1,237 Eggs
		Ashvale,	,, ,,	320	4 10	7 4	3	24	21	19	24	20	26	27	24	26	26	13	228	24	1	253	5	47	604	138	2 5	—	
		Lattin,	Jan. 23	321	5 2	7 2	10	19	17	17	19	23	20	19	11	14	15	6	183	7	—	190	—	46	461	138	2 7	—	(b) 26.9 oz.
		Tipperary.	Feb. 13	322	4 9	6 15	—	—	15	21	21	21	21	17	23	21	18	10	7	113	68	188	2	14	261	42	2 0	—	
			Jan. 23	323	4 14	7 4	—	13	16	18	21	25	22	23	19	17	15	8	57	125	15	197	8	29	406	87	2 2	—	(c) 2,675 Points
			Feb. 13	324	4 8	6 4	—	4	12	11	20	23	22	26	23	26	23	11	173	25	3	201	6	16	456	48	2 5	—	
4	104	Mrs. M. Browne,	Feb. 25	355	5 4	7 3	3	10	19	16	17	21	21	21	21	16	17	5	120	65	2	187	1	32	438	96	2 4	—	(a) 1,246 Eggs
		Ballybane,	,,	356	5 0	6 6	2	4	20	18	17	20	20	22	23	22	19	10	1	127	69	197	—	10	308	30	2 0	—	
		Firies,	,,	357	4 8	6 15	—	—	16	23	22	24	22	24	19	22	22	8	56	144	2	202	—	16	468	48	2 3	—	(b) 25.9 oz.
		Co. Kerry.	,,	358	5 2	6 11	—	—	7	19	23	27	24	27	21	23	23	9	185	18	—	203	8	7	452	21	2 6	—	
			,,	359	4 12	6 5	11	23	19	24	22	21	24	23	21	18	15	8	6	152	71	229	—	38	391	114	2 0	—	(c) 2,598 Points
			,,	360	5 8	7 11	—	11	23	21	25	22	23	24	24	22	23	10	86	140	2	228	—	34	541	102	2 3	—	
5	78	Mrs. L. Hayes,	Feb. 24	295	6 6	9 8	—	4	15	11	19	22	22	21	18	13	13	8	136	30	—	166	—	19	385	57	2 5	—	(a) 1,125 Eggs
		Walshestown,	,,	296	5 6	7 0	16	19	14	17	17	19	21	12	11	6	11	4	33	125	9	167	1	44	379	132	2 2	—	
		Castlemahon,	,,	297	5 10	7 4	—	3	21	20	15	19	25	26	24	21	24	11	99	113	1	213	—	23	503	69	2 3	—	(b) 26.9 oz.
		Newcastle West,	,,	298	5 10	7 0	7	4	—	7	9	19	25	25	23	25	23	11	164	14	—	178	—	11	426	33	2 5	—	
		Co. Limerick.	,,	299	5 12	7 6	—	16	12	16	20	20	24	25	24	21	24	11	207	6	—	213	2	28	505	84	2 6	—	(c) 2,574 Points
			,,	300	5 12	7 0	11	22	18	18	18	22	19	22	16	16	6	—	13	149	26	138	3	40	376	120	2 1	—	

D = Dead

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
6	84	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin	March 12	331	6 12	8 3	20	10	17	2	16	20	23	24	21	22	20	7	157	45	3	205	3	46	490	129	2 4	—	(a) 1,157 Eggs
			„	332	5 8	7 11	10	12	25	22	25	22	23	25	19	22	17	10	85	133	14	232	1	37	520	111	2 2	—	
			„	333	5 10	6 8	18	1	—	—	12	23	28	25	27	9	22	—	122	39	4	165	—	18	370	54	2 4	2	(b) 26.3 oz.
			„	334	5 6	6 12	—	—	3	12	17	18	23	22	23	20	20	—	40	115	3	158	—	2	352	6	2 3	—	
			„	335	5 8	6 3	—	8	18	19	11	9	25	24	25	17	10	6	1	110	61	172	—	17	266	51	2 0	1	(c) 2,522 Points
			„	336	6 3	8 8	—	11	20	22	24	27	20	22	21	21	15	13	148	75	2	225	1	31	524	93	2 4	—	
7	81	Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.	March	313	4 10	6 10	—	11	17	20	19	22	26	24	26	24	21	11	71	142	8	221	—	27	507	81	2 3	—	(a) 1,112 Eggs
			„	514	4 14	7 10	—	20	22	20	23	15	22	14	17	20	17	10	84	111	5	200	10	39	456	117	2 3	—	
			„	315	4 10	8 4	11	28	7	11	22	14	21	16	5	4	5	—	8	97	42	147	1	24	240	69	2 0	—	(b) 26.7 oz.
			„	316	4 10	7 11	—	16	20	20	22	18	24	21	26	13	19	9	202	6	—	208	1	36	490	108	2 6	—	
			„	317	5 2	8 7	—	20	20	22	25	25	17	7	6	—	7	9	69	83	1	158	5	40	360	120	2 3	—	(c) 2,476 Points
			„	318	4 12	7 0	—	15	21	18	23	13	23	18	13	16	6	12	148	30	—	178	1	36	425	105	2 5	1	
8	75	Mrs. E. McDonnell, Emila, Ballyferriter, Dingle, Co. Kerry.	Feb. 26	277	4 9	5 11	—	—	12	20	20	20	24	21	26	20	1	11	12	148	18	178	—	8	360	24	2 1	1	(a) 1,293 Eggs
			Jan. 20	278	4 13	D	2	19	18	14	19	21	23	21	17	15	D11	—	77	97	6	180	—	37	411	111	2 3	—	
			„	279	4 8	5 4	—	5	19	21	22	25	27	25	24	22	14	12	68	146	2	216	7	23	483	66	2 3	—	(b) 24.8 oz.
			Feb. 26	280	4 8	5 7	20	18	20	16	19	22	25	23	25	19	22	12	40	156	45	241	—	28	473	84	2 1	—	
			Jan. 20	281	4 8	5 15	16	21	21	19	20	21	24	25	23	20	24	12	9	172	65	246	—	24	438	72	2 0	—	(c) 2,378 Points
			„	282	4 9	5 7	20	21	19	18	20	22	20	22	23	20	19	8	2	85	145	232	1	4	213	12	1 15	—	
9	101	Capt. H. M. S. Redmond, Popefield, Athy. (Laoighis).	—	337	4 8	7 3	—	2	12	19	19	21	22	20	22	26	26	11	18	178	4	200	1	14	466	42	2 2	—	(a) 1,078 Eggs
			—	338	5 0	7 0	—	10	18	17	23	20	20	15	7	1	—	—	22	89	20	131	—	26	249	78	2 2	—	
			—	339	4 12	6 14	1	14	16	15	19	21	26	26	16	13	12	—	64	110	5	179	4	30	389	90	2 3	—	(b) 25 5 oz.
			—	340	4 8	5 0	—	15	16	17	18	18	22	23	23	21	11	7	8	166	17	191	—	28	413	84	2 1	—	
			—	341	4 8	6 3	9	13	18	17	20	22	27	17	12	4	22	10	94	86	11	191	—	39	425	117	2 3	—	(c) 2,344 Points
			—	342	4 8	5 11	—	—	11	15	14	24	24	22	22	22	20	12	1	172	13	186	—	10	402	30	2 1	—	
10	105	Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.	Feb. 11	361	4 9	D	—	5	24	20	23	20	19	16	—	D	—	—	19	105	3	127	—	27	275	81	2 2	—	(a) 1,058 Eggs
			„	362	5 8	9 0	—	4	22	26	23	26	24	25	24	19	19	8	87	133	—	220	7	26	498	78	2 3	—	
			„	363	5 0	7 7	—	—	11	15	19	10	22	16	6	—	—	1	—	28	72	100	—	7	63	21	1 14	—	(b) 25.2 oz.
			„	364	4 8	7 6	—	10	22	24	22	24	26	28	24	22	20	9	46	179	6	231	—	32	533	96	2 2	—	
			„	365	4 14	7 12	—	11	22	9	6	23	24	22	22	19	16	8	2	114	66	182	1	9	280	27	2 0	—	(c) 2,114 Points
			„	366	4 8	6 4	—	8	20	13	19	20	18	25	20	24	20	11	43	149	6	198	—	26	465	78	2 2	—	

D = Dead

SECTION IV.—RHODE ISLAND RED—(STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs p'r Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
11	83	Mr. W. Murphy,	Feb. 28	325	5 10	7 2	16	2	10	18	19	20	24	19	21	19	19	7	169	25	—	194	—	28	461	84	2 5	1	(a) 994 Eggs
		Skeeter Park,	" 4	326	5 10	8 0	5	17	21	20	23	24	24	18	13	14	18	9	74	125	7	206	5	38	467	114	2 3	—	
		Cleariestown,	" 28	327	5 12	7 8	21	21	24	22	16	19	13	8	11	5	10	3	60	106	7	173	65	65	267	195	2 2	—	(b) 26.2 oz.
		Co. Wexford.	" 28	328	5 14	7 8	3	23	21	20	22	23	25	19	21	13	16	12	57	146	15	218	—	43	490	120	2 2	2	
			" "	329	5 3	6 15	2	13	19	14	18	15	13	3	3	1	—	—	4	66	31	101	—	27	167	81	2 0	—	(c) 2,080 Points
			" "	330	5 4	D	—	7	17	16	17	20	12	D13	—	—	—	—	100	2	—	102	—	24	228	72	2 6	1	
12	103	Mrs. S. Collier,	March 10	349	4 10	6 7	22	18	21	22	21	21	23	21	23	18	14	9	46	120	67	233	3	14	381	42	2 1	—	(a) 1,043 Eggs
		Boggon,	"	350	5 0	D	12	8	2	2	—	—	8	D3	—	—	—	—	9	23	3	35	20	20	27	9	2 1	—	
		Kilbride,	"	351	5 0	5 15	—	17	17	11	19	21	18	22	11	12	11	—	4	84	71	159	—	14	211	42	2 0	—	(b) 24.9 oz.
		Tullow,	"	352	6 3	8 12	18	—	3	20	21	22	20	17	11	9	9	—	57	77	16	150	1	8	291	24	2 3	—	
		Co. Carlow.	"	353	4 15	6 11	16	16	18	20	17	24	22	26	27	23	21	10	78	159	3	240	4	47	567	141	2 2	—	(c) 1,961 Points
			"	354	5 0	6 10	7	22	21	22	23	25	21	26	24	17	16	2	6	200	20	226	1	48	484	144	2 1	—	
13	74	Mrs. K. Sammon,	Feb. 18	271	5 3	6 13	—	15	19	18	18	10	25	26	26	23	24	9	51	154	8	213	1	30	493	90	2 2	—	(a) 1,151 Eggs
		Carrigahorig,	"	272	5 8	7 3	—	17	19	16	16	20	19	21	17	16	16	5	139	44	2	185	103	35	195	102	2 4	—	
		Lorrha,	"	273	5 8	8 0	9	18	20	17	19	17	21	22	22	9	19	9	72	124	6	202	1	45	469	132	2 3	—	(b) 25.1 oz.
		Birr,	"	274	5 0	6 15	14	16	14	19	20	23	21	13	17	4	3	—	15	116	33	164	—	17	284	51	2 1	—	
		Offaly.	"	275	4 12	7 4	—	12	14	5	15	20	19	19	18	8	9	4	3	116	24	143	21	20	227	60	2 1	—	(c) 1,850 Points
			"	276	5 0	6 11	11	20	21	22	23	18	25	22	21	26	24	11	3	73	168	244	—	10	182	30	1 15	—	
14	79	Mrs. M. Brennan,	Jan. 21	301	4 12	7 1	6	15	12	14	18	19	19	19	19	18	19	8	—	154	32	186	—	21	368	63	2 0	—	(a) 897 Eggs
		Drummond,	"	302	4 15	6 14	3	21	17	16	21	24	24	23	7	21	10	9	4	100	92	196	1	29	257	84	1 15	—	
		St. Mullins,	"	303	5 2	D	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(b) 26.6 oz.
		Co. Carlow.	"	304	5 2	6 2	11	21	16	15	20	18	22	22	22	22	5	—	100	93	1	194	—	47	460	141	2 3	—	
			"	305	5 1	7 9	—	9	13	—	2	22	20	24	11	5	11	9	124	2	—	126	—	22	299	66	2 9	—	(c) 1,847 Points
			"	306	4 10	7 0	4	3	15	18	18	19	22	22	23	22	20	9	192	3	—	195	—	22	463	66	2 8	—	
15	102	Mrs. E. M. O'Flynn	March 1	343	4 8	6 2	12	8	21	16	20	21	26	23	26	21	23	11	42	172	14	228	—	34	516	102	2 2	—	(a) 1,114 Eggs
		Prohurst House,	"	344	4 8	6 0	12	13	13	14	18	20	24	25	23	23	24	9	5	182	31	218	1	26	450	78	2 0	—	
		Milford,	"	345	4 12	5 6	11	11	4	9	19	9	22	21	21	17	20	5	—	87	82	169	—	2	207	6	1 15	—	(b) 23.9 oz.
		Charleville,	"	346	4 8	5 11	1	19	17	15	13	—	—	—	—	—	—	—	—	18	47	65	—	18	54	54	1 14	—	
		Co. Cork.	"	347	5 2	6 1	3	—	15	18	23	25	24	26	26	27	19	10	1	180	35	216	—	13	426	39	2 0	—	(c) 1,734 Points
			"	348	5 0	5 7	15	15	11	12	19	20	23	22	24	24	22	11	—	35	183	218	—	5	81	15	1 14	—	

D = Dead

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in [illegible]	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 23	Oct. 25–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug 5–Aug. 13	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen
16	77	Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath	Feb.-Mar	289	4 9	D	17	1	7	4	—	—	D	—	—	—	—	—	8	17	4	29	—	21	71	63	2 1	—	(a) 292 Eggs
			"	290	5 0	6 4	11	20	9	5	13	22	25	22	24	23	22	11	74	125	10	209	—	57	485	111	2 2	—	
			"	291	4 9	D	—	—	—	—	—	5	14	D	—	—	—	—	15	4	—	19	—	—	38	—	2 5	—	(b) 25.5 oz.
			"	292	5 0	D	11	18	D6	—	—	—	—	—	—	—	—	—	1	20	14	35	—	21	63	63	1 15	—	
			"	293	4 8	D	—	—	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(c) 657 Points
			"	294	4 8	D	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

D = Dead

SECTION V.—ANY NON-SITTING BREED—10 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 15	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	
1	89	*White Leghorn* Mrs. M. O'Shea,	Jan. 31	481	3 10	4 4	1	11	16	7	16	22	22	22	22	17	18	8	53	128	1	182	—	27	432	81	2 3	—	(a) 1,207 Eggs
		Farrantane,	Feb. 10	482	3 12	4 12	16	9	9	14	19	15	20	26	22	21	24	11	75	129	2	206	—	32	496	96	2 3	—	(b) 25.6 oz.
		Castlegregory,	"	483	3 0	4 4	14	14	16	12	19	16	18	20	19	20	20	7	16	137	42	195	—	18	371	54	2 1	—	(c) 2,776 Points
		Co. Kerry.	"	484	3 12	4 15	1	13	14	19	19	18	19	19	17	18	20	11	51	133	4	188	—	26	412	78	2 2	—	
			"	485	3 6	4 9	9	14	15	18	20	22	25	26	26	26	24	11	31	199	6	236	—	35	558	105	2 2	—	
			"	486	3 15	5 11	7	14	11	12	13	16	23	24	22	24	24	10	74	123	3	200	1	29	479	87	2 3	—	
2	91	*White Leghorn* Mrs. A. Collins,	Jan. 11	493	4 1	5 12	—	—	1	17	23	15	22	21	21	21	19	7	42	119	6	167	—	—	269	—	2 3	—	(a) 1,146 Eggs
		Imanemore,	"	494	3 4	4 4	12	12	16	6	15	22	21	24	22	18	17	6	69	116	6	191	—	35	446	105	2 3	—	(b) 25.9 oz.
		Barnaderg,	"	495	3 8	5 3	—	13	16	18	21	18	24	24	22	23	19	9	45	148	14	207	—	23	459	69	2 2	—	(c) 2,526 Points
		Co. Galway.	"	496	4 0	5 3	—	2	4	4	18	19	21	24	23	21	14	7	57	101	2	160	—	6	393	18	2 3	—	
			"	497	4 0	4 14	11	15	15	13	15	21	24	22	21	24	20	11	9	152	51	212	—	4	381	12	2 0	—	
			"	498	4 1	5 13	5	18	13	12	19	17	24	21	23	21	22	11	184	25	—	209	—	36	508	108	2 5	—	
3	93	*White Leghorn* Sister-in-Charge,	March 15	505	4 2	6 3	4	12	6	8	20	21	22	21	19	10	3	6	150	5	—	155	1	22	349	66	2 8	—	(a) 1,104 Eggs
		St. Martha's College,	"	506	4 0	5 8	2	4	12	14	22	22	21	21	18	14	17	6	136	16	1	173	—	17	308	51	2 5	—	(b) 27.2 oz.
		Navan,	"	507	3 12	5 12	—	—	—	14	23	22	25	21	21	19	19	11	39	138	1	178	—	—	[illegible]	—	2 3	—	(c) 2,525 Points
		Co. Meath.	"	508	4 8	5 15	7	17	14	17	22	21	24	24	23	5	1	10	112	73	—	185	—	38	424	114	2 4	—	
			"	509	4 3	6 3	—	—	5	15	20	20	24	26	26	25	20	7	94	87	7	188	—	5	416	15	2 3	—	
			"	510	4 4	5 10	12	13	11	19	22	26	26	22	21	21	20	11	139	85	1	225	—	35	535	105	2 4	—	
4	94	*White Leghorn* Sister-in-Charge,	March 1	511	4 8	6 2	18	9	4	17	17	19	17	25	21	17	22	9	162	30	1	193	—	39	462	90	2 5	—	(a) 1,068 Eggs
		R.D.E. School,	"	512	4 0	5 11	3	14	11	17	19	20	22	21	23	17	17	1	162	23	1	186	—	27	433	81	2 5	—	(b) 27.1 oz.
		Swinford,	"	513	4 6	6 3	10	19	11	19	14	15	—	2	4	—	—	—	62	26	4	92	1	53	214	114	2 4	—	(c) 2,509 Points
		Co. Mayo.	"	514	4 6	5 3	11	17	13	18	17	21	21	21	23	19	14	7	77	121	4	202	2	38	470	114	2 3	—	
			"	515	4 3	6 4	—	14	17	17	19	16	22	21	23	23	22	11	199	6	—	205	—	31	407	93	2 7	—	
			"	516	4 0	5 7	2	2	8	18	23	20	22	21	22	21	22	9	80	105	5	190	—	11	433	33	2 3	—	
5	92	*White Leghorn* Mrs. F. E. Hanbidge,	Jan. 22	499	4 12	6 2	—	3	13	18	21	18	23	18	22	17	11	7	158	12	2	172	—	15	390	45	2 6	—	(a) 1,170 Eggs
		Blackrath,	"	500	4 8	5 8	1	19	13	16	22	22	21	21	22	25	18	11	133	75	3	211	—	32	502	96	2 4	—	(b) 25.9 oz.
		Ballytore,	March 3	501	3 12	4 2	—	11	10	16	19	21	19	22	19	20	19	6	16	142	24	182	—	7	335	21	2 1	—	(c) 2,206 Points
		Co. Kildare.	Jan. 22	502	4 1	5 5	8	8	—	14	21	20	24	24	24	21	22	9	162	33	—	195	21	16	410	30	2 4	—	
			March 3	503	3 9	4 7	—	14	—	19	22	23	27	25	26	25	22	11	2	57	155	214	—	3	132	9	1 15	—	
			Jan. 22	504	5 0	6 15	1	17	16	19	20	20	20	22	19	15	17	10	22	151	23	196	—	30	407	90	2 1	—	

Key to last column: (a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.

D = Dead

SECTION V.—ANY NON-SITTING BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weigh per dozen. (c) Scoring Points per Pen
6	90	*White Leghorn* Miss A. Fitzgerald,	March 10	487	4 8	5 15	14	14	19	15	20	17	22	23	22	23	20	4	47	153	13	213	—	40	486	120	2 2	—	(a) 1,111 Eggs
		Ardgoul,	”	488	4 2	5 7	4	19	17	19	22	19	23	22	17	12	18	3	16	130	49	195	—	6	351	18	2 0	—	(b) 25.2 oz.
		Rathkeale,	”	489	3 12	4 9	10	5	5	20	22	22	23	23	24	20	19	8	24	154	23	201	—	5	408	15	2 1	—	(c) 2,190 Points
		Co. Limerick.	”	490	3 9	4 11	13	—	16	14	18	18	22	18	19	21	15	10	124	60	—	181	—	29	443	87	2 4	—	
			”	491	3 8	3 11	5	2	9	15	19	16	23	22	21	19	16	—	26	118	23	167	—	11	326	33	2 2	—	
			”	492	3 8	4 5	4	20	3	—	19	22	25	23	23	12	—	—	1	88	62	151	—	12	196	36	2 0	—	
7	95	*White Leghorn* Mrs. M. A. Walsh,	March	517	3 6	5 8	7	19	17	17	19	15	22	22	22	19	21	8	181	27	—	208	5	43	492	114	2 6	—	(a) 1,098 Eggs
		Wardstown,	”	518	3 0	5 2	7	4	9	19	19	17	25	23	22	20	21	12	86	104	8	198	—	14	447	42	2 3	—	(b) 25.7 oz.
		Athboy,	”	519	3 6	5 7	2	10	8	2	22	22	24	19	12	18	18	4	8	104	49	161	—	8	268	24	2 0	—	(c) 2,189 Points
		Co. Meath.	”	520	3 0	D	14	16	12	18	16	16	24	21	D3	—	—	—	4	55	81	140	—	—	118	—	1 15	—	
			”	521	3 4	5 8	—	11	17	18	19	21	26	25	24	21	19	—	101	99	1	201	—	28	467	84	2 3	—	
			”	522	3 4	5 7	7	8	17	10	14	16	23	24	19	22	21	9	3	161	26	190	—	17	397	51	2 1	—	
8	96	*White Leghorn* Mrs W. Byrne,	Feb. 17	523	3 9	4 12	10	15	14	20	18	22	26	21	20	21	19	10	54	137	28	219	—	23	457	69	2 2	—	(a) 1,114 Eggs
		Kilcar,	”	524	4 8	5 12	18	15	13	18	19	18	18	12	12	3	3	2	61	49	41	151	1	8	234	24	2 2	—	(b) 24.9 oz.
		Curraghboy,	”	525	3 15	4 10	17	14	12	15	18	18	24	23	20	15	17	3	10	131	55	196	—	4	321	12	2 0	—	(c) 2,039 Points
		Athlone,	”	526	3 9	D	7	11	10	19	20	21	27	15	8	D6	—	—	1	68	75	144	—	1	145	3	1 15	—	
		Co. Roscommon.	”	527	3 8	4 11	11	14	15	17	18	18	23	24	20	16	17	9	40	147	15	202	—	32	447	96	2 2	—	
			”	528	3 8	5 1	18	5	14	15	16	22	23	22	25	22	15	5	72	113	17	202	—	23	435	69	2 2	—	
9	97	*White Leghorn* Rev. Bro. Dominick,	March	529	4 0	4 9	12	16	16	18	18	16	19	21	21	17	16	5	17	150	28	195	1	30	396	90	2 1	—	(a) 829 Eggs
		Agricultural College,	”	530	4 12	6 10	19	17	17	18	18	17	20	21	21	16	11	10	97	101	10	208	—	46	182	138	2 3	—	(b) 24.7 oz.
		Mountbellew,	”	531	4 0	D	13	17	1	—	13	15	19	14	—	—	D	—	—	6	86	92	—	—	12	—	1 12	—	(c) 1,477 Points
		Co. Galway.	”	532	3 4	D	—	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
			”	533	3 12	5 6	8	11	11	14	14	20	22	21	16	22	19	7	65	108	12	185	—	26	419	78	2 3	—	
			”	534	3 4	3 14	17	14	8	—	11	13	16	16	18	13	18	5	—	68	81	149	—	15	168	45	1 15	—	
10	98	*White Leghorn* Mrs. M. Hanly,	April 10	535	3 4	5 6	—	—	—	—	—	5	6	7	13	13	4	2	33	16	1	50	—	—	116	—	2 4	—	(a) 657 Eggs
		Cooga,	”	536	3 4	D	—	11	10	—	15	20	21	20	20	6	—	D	52	66	8	126	—	13	255	39	2 5	—	(b) 26.2 oz.
		Doon,	”	537	3 4	5 11	—	—	2	13	15	19	22	21	18	17	18	5	19	103	31	153	2	—	266	—	2 0	—	(c) 1,338 Points
		Co. Limerick.	”	538	3 9	5 10	—	—	—	6	6	12	21	2	—	—	—	—	7	39	1	47	—	—	92	—	2 2	—	
			”	539	3 8	5 0	—	—	—	3	20	20	19	20	16	8	7	4	48	65	4	117	1	—	240	—	2 4	—	
			”	540	3 12	5 7	—	9	11	4	24	20	25	22	20	15	9	5	97	64	3	164	—	20	369	60	2 4	—	

SECTION VI.—ANY OTHER UTILITY BREED—13 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct 1–Dec 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weigh per dozen. (c) Scoring Points per Pen.
1	107	*Light Sussex*	Feb. 8	433	5 8	8 3	19	19	3	14	20	19	18	13	22	13	11	6	128	44	5	177	—	36	410	108	2 4	3	(a) 1,007 Eggs
		Sister-in-Charge,	,, ,,	434	5 12	8 6	—	6	14	14	17	17	23	20	20	22	17	9	123	50	6	179	—	15	409	45	2 4	—	(b) 27.0 oz
		St. Martha's College,	,, 20	435	5 0	6 10	—	—	3	18	21	23	23	24	24	19	16	9	42	126	12	180	1	—	377	—	2 2	—	(c) 2,274 Points
		Navan,	,, 8	436	5 12	7 7	14	20	17	15	18	15	20	17	7	14	7	2	127	41	1	169	1	50	406	150	2 4	1	
		Co. Meath.	,, 20	437	6 5	8 10	—	—	18	23	19	21	17	22	12	16	15	6	163	6	—	169	—	18	393	54	2 6	—	
			,, ,,	438	5 9	8 6	11	14	15	13	14	16	20	11	13	2	4	—	43	82	8	133	4	35	279	99	2 2	—	
2	109	*Light Sussex*	Jan. 26	445	6 0	7 1	16	—	10	20	22	17	25	24	15	24	18	5	90	107	—	197	—	26	467	78	2 3	2	(a) 956 Eggs
		Mrs. M. Keatley,	,,	446	6 0	6 15	16	1	16	2	23	15	24	20	22	14	11	7	86	80	5	171	—	33	396	99	2 3	4	(b) 26.5 oz.
		Boakefield,	,,	447	6 0	8 1	—	2	21	19	18	19	24	14	6	12	9	1	6	132	7	145	—	22	319	66	2 2	1	(c) 2,231 Points
		Ballytore,	,,	448	5 12	6 6	12	6	14	9	20	13	23	24	16	20	16	12	71	107	7	185	—	31	434	93	2 2	—	
		Co. Kildare.	,,	449	5 1	5 14	1	20	16	9	10	8	24	20	11	9	16	—	126	18	—	144	1	37	348	111	2 6	3	
			,,	450	5 2	6 4	—	10	6	14	8	13	18	13	9	12	10	1	44	70	—	114	—	16	267	48	2 3	2	
3	110	*Light Sussex*	Feb. 20	451	5 0	5 8	—	8	18	11	21	24	23	22	14	19	10	—	95	73	2	170	12	26	367	78	2 4	1	(a) 1,110 Eggs
		Miss M. Mullen,	,,	452	5 1	6 11	1	19	15	2	22	24	24	18	19	14	16	7	6	70	105	181	—	34	194	102	1 15	—	(b) 25.6 oz.
		Lisaniskea,	,,	453	5 8	6 15	8	22	11	17	22	25	21	14	10	16	14	—	109	71	—	180	1	41	429	123	2 4	2	(c) 2,203 Points
		Clara,	,,	454	5 0	5 15	—	18	18	17	14	24	25	22	23	19	18	10	7	160	41	208	2	24	391	72	2 0	—	
		Offaly,	,,	455	5 8	7 0	9	19	16	17	18	15	18	17	15	15	10	3	111	55	6	172	—	42	402	126	2 4	—	
			,,	456	5 4	6 13	5	20	17	8	21	23	26	18	20	15	19	7	33	143	23	199	—	27	120	81	2 2	—	
4	106	*Light Sussex*	Feb. 12	427	5 8	5 15	—	—	5	16	18	18	21	17	14	10	12	10	47	90	4	141	—	5	311	15	2 3	1	(a) 1,041 Eggs
		Mrs. M. Comerford,	,,	428	5 10	6 15	—	—	11	17	20	21	24	22	19	12	10	8	73	88	3	161	—	11	362	33	2 3	—	(b) 25.5 oz.
		Lamogue,	,,	429	5 11	D	—	10	14	18	20	23	26	19	9	9	22	D	117	53	—	170	—	24	395	72	2 4	1	(c) 2,065 Points
		Windgap.	,,	430	5 14	7 2	—	24	20	16	19	21	18	22	22	23	19	9	23	169	21	213	—	32	466	96	2 1	—	
		Co. Kilkenny.	,,	431	5 4	7 2	—	—	16	9	15	20	20	17	16	7	13	10	78	63	2	143	—	16	328	48	2 4	—	
			,,	432	5 8	6 3	20	20	19	18	20	18	22	21	23	11	11	7	1	87	122	210	—	10	202	30	1 15	1	
5	116	*Light Sussex*	Jan. 29	373	6 8	6 12	5	22	10	21	21	22	25	19	16	9	12	—	—	64	118	182	—	11	154	33	1 15	2	(a) 1,145 Eggs
		Mrs. J. Hely-Hutchinson,	Feb. 22	374	5 14	7 4	20	11	12	11	17	19	21	18	20	8	11	—	105	57	6	168	6	42	368	123	2 3	—	(b) 24.9 oz.
		Lissen Hall,	Jan. 29	375	5 7	7 13	—	—	4	15	21	22	23	18	16	2	4	—	48	75	2	125	—	4	256	12	2 3	—	(c) 2,056 Points
		Swords,	Feb. 22	376	5 14	6 12	—	—	22	21	24	27	27	26	22	24	23	10	46	154	26	226	2	21	463	63	2 2	—	
		Co. Dublin.	Jan. 29	377	5 6	6 13	6	16	18	22	19	19	26	24	18	20	17	9	14	186	14	214	—	35	481	105	2 1	—	
			Feb 22	378	5 15	8 0	16	23	16	18	22	24	23	25	21	18	15	9	—	130	100	230	—	38	334	114	2 0	—	

D = Dead

SECTION VI.—ANY OTHER UTILITY BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
6	108	*Light Sussex* Mrs. D. Martin,	Feb. 1	439	5 8	6 9	3	8	6	—	15	10	13	8	14	12	11	8	6	68	34	108	—	2	175	6	2 0	5	(a) 919 Eggs
		Kilkeelan,	„	440	6 1	6 15	—	—	1	17	22	22	18	10	9	—	11	—	12	96	2	110	—	—	227	—	2 2	1	
		Athboy,	„	441	5 6	6 13	—	—	20	17	20	26	26	25	17	13	20	7	33	144	14	191	—	18	412	54	2 2	—	(b) 26.1 oz.
		Co. Meath.	„	442	6 6	8 7	11	18	22	18	23	18	19	14	8	7	14	5	115	59	3	177	—	50	424	150	2 4	—	
			„	443	6 12	7 4	—	—	21	18	22	21	20	23	18	22	23	10	153	50	1	204	—	20	481	60	2 5	—	(c) 2,009 Points
			„	444	5 2	6 6	—	—	8	16	13	10	20	18	15	14	15	—	30	97	2	129	—	8	290	24	2 3	2	
7	117	*Buff Rock* Mrs. M. A. Walshe,	Jan. 21	379	5 2	5 0	—	—	3	15	16	15	15	13	—	—	—	—	70	7	—	77	—	3	157	9	2 6	—	(a) 832 Eggs
		Tullamore,	„	380	5 0	7 7	—	—	7	15	19	20	23	24	22	19	20	12	177	4	—	181	—	7	420	21	2 7	—	
		Listowel,	„	381	5 0	6 0	—	15	15	20	15	23	16	22	10	20	3	8	41	126	—	167	—	30	395	90	2 2	2	(b) 27.6 oz.
		Co. Kerry.	„	382	5 3	6 12	—	—	11	15	18	12	15	12	20	19	11	9	27	111	4	142	—	9	324	27	2 2	—	
			„	383	5 1	6 15	—	15	18	15	19	21	16	1	2	21	7	10	139	6	—	145	—	33	361	99	2 6	1	(c) 1,908 Points
			„	384	6 0	8 1	—	—	11	19	19	24	23	16	8	—	—	—	105	15	—	120	—	11	251	33	2 6	—	
8	111	*Light Sussex* Mrs. H. Delaney,	March 1	457	5 0	6 10	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	1	3	3	2 4	—	(a) 824 Eggs
		Coolbawn,	„	458	5 1	8 6	9	20	18	7	21	16	24	15	13	12	14	8	124	46	7	177	—	44	417	132	2 5	1	
		Castlecomer,	„	459	5 1	6 13	—	20	10	15	8	8	20	22	20	14	20	6	67	91	5	163	1	29	382	84	2 3	2	(b) 26 9 oz.
		Co. Kilkenny.	„	460	5 8	7 2	2	10	3	12	19	12	25	12	15	15	17	3	121	20	4	145	3	13	322	39	2 6	—	
			„	461	5 0	7 7	—	11	17	13	23	17	23	20	6	17	11	4	120	41	1	162	—	27	381	81	2 4	2	(c) 1,897 Points
			„	462	5 0	6 1	7	19	18	11	16	21	22	19	12	16	10	5	25	140	11	176	4	39	392	117	2 1	1	
9	118	*Buff Rock* Mrs. A Coleman,	March	385	5 0	6 7	17	13	15	10	16	15	14	7	18	2	1	—	121	7	—	128	—	45	304	135	2 6	—	(a) 822 Eggs
		Ballycullen House,	„	386	5 6	7 10	4	5	—	1	7	23	26	18	11	12	13	7	69	58	—	127	10	9	275	27	2 4	1	
		Croom,	„	387	5 9	D	17	13	5	—	—	—	—	—	D	—	—	—	19	16	—	35	—	35	105	105	2 2	—	(b) 26.8 oz.
		Co. Limerick.	„	388	5 0	6 14	9	18	18	17	18	9	—	—	—	—	—	—	26	55	8	89	1	41	201	123	2 2	—	
			„	389	5 0	5 11	12	14	16	18	16	22	28	21	24	12	22	9	179	35	—	214	—	42	513	126	2 5	—	(c) 1,883 Points
			„	390	5 3	7 7	18	16	15	15	19	20	24	24	22	24	21	11	49	147	33	229	—	44	485	132	2 2	—	
10	115	*Light Sussex* Mrs. A. Murphy,	Feb. 15	367	5 2	6 14	1	18	17	—	8	16	23	22	19	15	13	6	27	106	25	158	—	26	326	78	2 2	—	
		Brittas,	„	368	5 0	6 5	—	1	7	7	8	17	15	23	21	18	10	9	—	38	98	136	2	4	85	12	1 15	—	
		Inistioge,	„	369	5 12	7 6	18	22	10	18	10	11	18	5	8	1	—	—	8	73	40	121	—	44	207	132	2 0	—	
		Thomastown,	„	370	5 12	D	—	22	18	12	5	9	D	—	—	—	—	—	2	25	39	66	6	16	58	48	1 15	—	(b) 25.3 oz.
		Co. Kilkenny.	„	371	5 2	7 2	15	17	18	19	21	19	24	23	23	20	20	10	176	52	1	229	—	49	555	147	2 5	—	(c) 1,658 Points
			„	372	5 2	7 3	6	19	6	18	21	23	24	18	15	13	19	4	65	116	5	186	—	29	427	87	2 3	2	

D=Dead

SECTION VI.—ANY OTHER UTILITY BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 17	Mar. 18–Apl. 14	Apl. 15–May 12	May 13–June 9	June 10–July 7	July 8–Aug. 4	Aug. 5–Aug. 18	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
11	114	*Light Sussex* Sister-in-Charge, St. Mary's Abbey, Glencairn, Co. Waterford.	Jan. 25	475	6 5	5 15	18	16	17	16	18	13	18	15	13	8	9	4	92	73	—	165	2	51	398	153	2 4	—	(a) 1,118 Eggs
			"	476	5 12	6 11	4	—	14	18	20	21	25	17	26	24	23	11	118	79	6	203	1	18	468	54	2 3	—	
			"	477	6 3	D	19	15	23	22	17	20	24	5	D	—	—	—	5	73	67	145	—	38	191	114	2 0	—	(b) 24.2 oz.
			"	478	5 8	6 7	19	19	22	20	21	18	23	19	25	21	19	12	6	145	87	238	—	17	366	51	2 0	2	
			March 23	479	5 4	6 4	—	11	21	12	21	27	24	25	23	21	21	11	2	11	207	220	—	5	31	15	1 13	—	(c) 1,615 Points
			Jan. 25	480	6 3	7 3	19	23	18	15	16	13	12	10	7	9	5	—	4	58	85	147	—	25	158	75	1 15	—	
12	113	*Light Sussex* Mrs. D. Martin, Kilkeelan, Athboy, Co. Meath.	Feb. 1	469	5 1	6 4	—	—	1	17	18	18	21	24	22	9	21	1	122	29	1	152	—	—	333	—	2 4	—	(a) 741 Eggs
			"	470	5 3	6 11	—	17	21	19	1	19	15	19	22	15	11	8	22	99	46	167	—	18	292	54	2 1	2	
			"	471	5 2	7 6	—	13	21	1	10	20	16	15	16	13	14	11	1	105	44	150	—	17	258	51	2 0	2	(b) 25.1 oz.
			"	472	6 0	7 5	—	—	—	—	4	16	9	—	6	16	1	7	3	19	37	59	—	—	53	—	1 15	4	
			"	473	6 8	8 0	—	—	—	—	—	19	13	4	4	11	5	3	42	16	1	59	1	—	133	—	2 4	2	(c) 1,353 Points
			"	474	5 2	6 15	—	—	—	19	13	18	22	20	16	20	18	2	2	121	31	154	—	—	284	—	2 1	—	
13	112	*Light Sussex* Mrs. K. Cuddihy, Hillside P.F., Glenmore, Co. Kilkenny.	February	463	5 8	7 0	19	25	18	15	19	13	21	19	18	10	15	4	—	9	187	196	—	1	26	3	1 12	—	(a) 1,126 Eggs
			"	464	5 4	6 5	—	—	12	20	20	21	24	23	22	17	14	5	1	95	82	178	1	3	213	9	2 0	—	
			"	465	5 12	7 3	21	18	17	16	18	22	21	21	16	21	11	8	21	176	13	210	—	51	483	153	2 1	—	(b) 23.4 oz.
			"	466	6 0	6 3	15	—	—	—	16	18	26	14	14	12	10	—	—	23	102	125	—	—	60	—	1 14	4	
			"	467	6 0	7 5	14	20	15	15	15	22	21	19	20	18	23	7	4	92	113	209	4	21	241	63	1 15	—	(c) 1,316 Points
			"	468	6 1	7 3	—	17	16	17	21	26	26	23	25	16	12	9	15	109	84	208	1	11	293	33	2 0	1	

D = Dead.

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Trials on the Storage of Undried and Kiln-dried Spring Wheat Seed at the Department's Cereal Station, Ballinacurra, Co. Cork.

The object of these trials was to determine the effect of storage on the germination of wheats having different moisture content levels.

Two trials were conducted, one in 1942-43, the other in 1943-44. The seed used in both was pedigree Red Marvel wheat of the current season, well saved, of excellent quality and re-screened before storing. It is worth mention that the same very dry loft of a grain store was used for storage in both seasons. Kiln-drying was done within a week or so of threshing on a flat, tiled kiln at a maximum temperature of 110°-115° F. in the grain.

1942-1943 TRIAL.

On the 29th September, after a preliminary test had shown the grain to contain 18.2 per cent. moisture, 5 barrels were retained undried. The remainder was kiln-dried. Tests were done during drying and when the moisture content had been reduced to approximately 16 per cent. about one-third of the kiln was unloaded. A further one-third was unloaded at 15 per cent. and the remainder at 14 per cent.

Between the 1st and 5th October each lot was separately screened, weighed, sampled and tested and spread in 2½ feet deep heaps on the loft. The following are the particulars of each lot :—

Lot 1—Undried ..	12½ cwt.	..	18.2 per cent. moisture.
„ 2—Kiln-dried ..	65 „	..	15.9 „ „
„ 3— „	50 „	..	13.9 „ „
„ 4— „	65 „	..	13.3 „ „

The grain was warm when unloaded from the kiln and further loss of moisture continued as it cooled, with the result that somewhat lower moisture contents than those aimed at were obtained.

Germination and moisture tests were carried out at approximately fortnightly intervals ; the results are given in Tables I and II. Both tests were done on the same sample and each sample was a composite of surface, shallow and deep subsamples from each heap.

The relative humidity of the store atmosphere was recorded daily. The averages of these readings for the inter-sampling periods are also given in Table I.

TABLE I.

Date of Sampling and Testing	Relative Humidity	Moisture Per Cent.			
		Lot 1	Lot 2	Lot 3	Lot 4
Oct. 3, 1942 ..	—	18.2	15.9	13.9	13.3
,, 15, ,, ..	90.2	17.6	15.8	14.8	13.7
,, 30, ,, ..	93.2	18.1	16.2	15.0	14.3
Nov. 11, ,, ..	90.5	18.5	16.6	15.2	14.4
,, 26, ,, ..	94.3	18.3	16.0	15.0	14.2
Dec. 11, ,, ..	93.3	18.5	16.4	15.6	14.6
,, 21, ,, ..	95.1	18.5	16.7	15.7	14.5
Jan. 13, 1943 ..	94.2	18.5	16.5	15.7	14.8
,, 27, ,, ..	95.4	18.4	16.6	15.3	14.6
Feb. 10, ,, ..	87.0	17.8	15.5	14.8	14.4
,, 15, ,, ..	81.0	18.2	15.9	15.4	14.8
Mar. 1, ,, ..	80.0	18.2	16.4	15.4	14.4

Except for a few relatively small fluctuations, the moisture content of the undried wheat (Lot 1) remained practically constant throughout the trial. The drier, kiln-dried lots absorbed moisture to a greater extent than the undried lot but the greatest increase was only 1.8 per cent.

Beyond the observation that the greatest moisture intake occurred during the period up to 27th January—a period of high relative humidity, much information cannot be extracted from comparison of the relative humidity and moisture content figures. The fluctuations of the latter, which are more or less concurrent in all lots, are not in accord with the fluctuations of relative humidity.

TABLE II.

Date of Sampling and start of Test	Germination per cent. of			
	Lot 1	Lot 2	Lot 3	Lot 4
Oct. 1, 1942 ..	88	88	88	88
,, 3, ,, ..	85	91	96	90
,, 8, ,, ..	83	92	91	94
,, 15, ,, ..	85	99	99	99
,, 30, ,, ..	98	100	99	99
Nov. 11, ,, ..	96	99	99	100
,, 26, ,, ..	93	98	99	99
Dec. 11, ,, ..	96	99	99	99
,, 21, ,, ..	96	99	99	100
Jan. 13, 1943 ..	97	99	99	100
,, 26, ,, ..	97	99	100	99
Feb. 10, ,, ..	97	99	99	99
Mar. 1, ,, ..	97	99	99	99

It will be observed from Table II that all lots satisfactorily retained their germinative power to the end of the trial.

Although the percentage germination of the undried wheat (Lot 1) was but slightly lower than that of the kiln-dried lots throughout the trial, its energy of germination was appreciably lower in all of its tests.

The fact that on the 27th October a fire was first lighted and subsequently maintained in the room in which the tests were being done may account for the sudden and permanent improvement in the germination of Lot 1 on and from the 30th October. It cannot, however, be held accountable for the earlier and more gradual improvement of the germination of the kiln-dried lots.

Samples taken on the 16th February from each heap from the surface, from medium depth and from full depth were separately tested. Although only one such set of tests was made the particulars given in Table III are of interest. They indicate that the kiln-dried heap surfaces had a higher moisture content than their mid-depths, and that very little moisture content change occurred at any of the heap centres.

TABLE III.

	Moisture Per Cent.			*Germination Per Cent.*		
	Surface	Mid-depth	Full depth	Surface	Mid-depth	Full depth
Lot 1	18.7	—	18.5	98	—	98
Lot 2 ..	17.5	16.5	16.2	98	98	98
Lot 3	17.5	15.6	14.4	96	98	99
Lot 4	17.4	14.3	13.5	98	100	100

1943-1944 TRIAL.

In this trial, following kiln-drying and screening, the lots were sub-divided, as shown in Table IV.

TABLE IV.

Lot	Weight Cwt.	Treatment	Storage	Moisture Per Cent.
1	12½	Undried	In sacks	18.3
2	12½	Undried	In heap, turned fortnightly	18.3
3	25	Kiln-dried	In sacks	16.1
4	25	Kiln-dried	In heap, turned fornightly	16.1
5	27½	Kiln-dried	In heap, undisturbed	16.1
6	25	Kiln-dried	In sacks	14.9
7	25	Kiln-dried	In heap, turned fortnightly	14.9
8	30	Kiln-dried	In heap, undisturbed	14.9

The sacks, each containing 20 stones, were left untied. The heaps were made $2\frac{1}{2}$ feet deep. At fortnightly intervals samples were taken for moisture and germination tests. About three days prior to each sampling and as far as possible during a dry spell the heaps of Lots 2, 4 and 7 were well turned.

DETERMINATION OF MOISTURE CONTENTS.

Except in the case of the turned heaps (Lots 2, 4 and 7), of which well mixed bulk samples were tested, it was considered advisable, in view of the experience of the previous trial, to test separately sub-samples from the sacks and from the undisturbed heaps. The method of sampling and of arriving at the moisture contents of these lots was as described below.

Subsamples were taken from the sacks at mid height; No. 1, at the outer edge; No. 3, at the centre and No. 2, half way between. Although full sacks are not geometrically cylindrical they approximate so closely to this shape as to warrant its assumption in calculating the relative volumes of grain represented by the subsamples. Accordingly, the amounts of grain represented by the subsamples Nos. 1, 2 and 3 are approximately in the proportion of 5 : 3 : 1, respectively, and in calculating the moisture contents given in Table V of the lots stored in sacks these proportions were taken into consideration.

Subsamples were taken from each of the undisturbed heaps (Lots 5 and 8) from the surface and from about 10 inches and 24 inches from the surface. Without the aid of heap dimensions the allocation of proportions of the heaps to these subsamples is to some extent arbitrary. Considering, however, that the penetration of moisture into these heaps or into the sacks was negligible at about 10 inches from the surface; that the moisture content of the wheat at this depth remained practically unchanged, it is obvious that a mere simple average would give too high a value to the moisture content of the heap as a whole. Since the heaps were $2\frac{1}{2}$ feet deep the moisture contents of these lots given in Table V were arrived at by allocating a 6 inch layer or 1–5th of the grain to the surface readings, a like amount to the 10 inch readings and the remainder to the deep readings.

The moisture content of each of the subsamples is given in Table VI.

The average relative humidity for each of the inter-sampling periods compiled from daily readings on the store loft is given in Table V.

TABLE V.

Date of Test	Relative Humidity per cent.	Moisture per cent.							
		Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8
October 7, 1942	—	18.05	18.05	16.10	16.10	16.10	14.90	14.90	14.90
,, 21, ,,	84.2	18.10	18.07	16.32	16.10	16.18	15.32	15.10	15.01
Nov. 9, ,,	84.2	18.10	18.07	16.41	16.13	16.13	15.62	15.20	15.13
,, 23, ,,	80.2	18.15	18.10	16.52	16.15	16.23	15.76	15.25	15.23
Dec. 7, ,,	85.3	18.22	18.20	16.76	16.20	16.31	15.97	15.25	15.29
Jan. 4, 1943	85.8	18.26	18.10	16.90	16.30	16.37	16.26	15.50	15.39
,, 18, ,,	83.6	18.41	18.30	17.13	16.60	16.44	16.45	15.70	15.46
Feb. 1, ,,	86.7	18.72	18.45	17.36	16.90	16.50	16.64	16.00	15.64
,, 15, ,,	85.6	18.72	18.50	17.40	16.90	16.50	16.63	16.30	15.54
,, 25, ,,	83.0	18.72	18.55	17.41	16.80	16.42	16.64	16.50	15.52

TABLE VI.

Moisture Per Cent. of Subsamples.

	Oct.		Nov.		Dec.	Jan.		Feb.		
	7th	21st	9th	23rd	7th	4th	18th	1st	15th	25th
Lot 1 (Sacks) No. 1 ..	—	18.1	18.1	18.2	18.3	18.4	18.6	19.05	18.8	18.8
No. 2 ..	18.05	18.06	18.06	18.1	18.15	18.1	18.2	18.3	18.65	18.7
No. 3 ..	—	18.1	18.1	18.05	18.05	18.05	18.1	18.3	18.5	18.5
Lot 3 (Sacks) No. 1 ..	—	16.5	16.65	16.8	17.2	17.5	17.9	18.3	18.2	18.1
No. 2 ..	16.1	16.1	16.1	16.2	16.25	16.2	16.2	16.2	16.4	16.6
No. 3 ..	—	16.1	16.1	16.1	16.1	16.0	16.1	16.1	16.2	16.4
Lot 5 (Heap) Surface ..	—	16.5	16.65	16.7	17.03	17.35	17.7	18.3	18.0	17.7
Shallow ..	16.1	16.1	16.0	16.15	16.2	16.2	16.2	16.2	16.2	16.1
Deep ..	—	16.1	16.0	16.1	16.1	16.1	16.1	16.0	16.1	16.1
Lot 6 (Sacks) No. 1 ..	—	15.6	16.15	16.4	16.7	17.15	17.5	17.85	17.7	17.6
No. 2 ..	14.9	15.0	15.0	15.0	15.1	15.2	15.2	15.3	15.6	15.7
No. 3 ..	—	14.85	14.80	14.85	14.9	14.86	14.85	14.9	15.0	15.2
Lot 8 (Heap) Surface ..	—	15.6	16.4	16.7	17.0	17.3	17.7	18.6	17.9	17.5
Shallow ..	14.9	14.9	14.85	14.9	14.9	15.25	14.9	14.9	15.1	15.4
Deep ..	—	14.85	14.8	14.85	14.85	14.8	14.9	14.9	14.9	14.9

From the moisture test results given in Tables V and VI it will be observed that :—

(1) Increases occurred in all lots, and, except for a slight acceleration during the month of January, the rate of increase of each lot was fairly steady throughout the trial.

(2) The data for relative humidity do not show very much variation throughout the experimental period and there does not appear to be much association between these figures and the variations in the moisture contents.

(3) Under like conditions of storage the increases were inversely related to the initial moisture contents.

(4) The intake of moisture was greater in the lots stored in sacks than in their turned heap counterparts, and these latter in turn absorbed more moisture than their undisturbed heap counterparts.

Observations (3) and (4) are made clear by the following Table (Table VII) which gives the difference between the final and initial moisture contents of each lot and by the graphs shown in Figure 1.

TABLE VII.

	Initial Moisture per cent.		
	18.05	16.1	14.9
Sacks	0.68	1.3	1.74
Turned Heaps ..	0.5	0.7	1.6
Unturned Heaps ..	—	0.3	0.6

(5) Moisture absorption was greatest at the surfaces of heaps and sacks. (See Figs. II and III).

(6) Its inward penetration was not sufficient to alter the centres of the undisturbed heaps, was barely sufficient to alter the centres of the kiln-dried sack lots and but slightly more the centres of the undried sack lots.

(7) There are indications that the inward penetration of moisture was more effective the higher the initial moisture content.

Germination tests were done on all lots stored in turned heaps and in sacks. In the case of the latter the tests were done on the mixed subsamples. The conditions of testing were as uniform as possible throughout the trial. There were no observable differences between the lots in vigour of germination. The results given in Table VIII show that :—

All lots satisfactorily retained their germinative power throughout the trial.

There were no differences between the lots whether dried or undried, stored in sacks or heaps.

There was a noticeable improvement in the fourth day count, a less noticeable improvement in the seventh day count and a very slight improvement in the final 10th day count of all lots in the fortnight following the start. Since this feature is common to all lots it cannot be attributed to kiln-drying or the lack of it.

TABLE VIII

Germination Per Cent.

	Count	Test started									
		Oct. 7th	Oct. 21st	Nov. 9th	Nov. 23rd	Dec. 7th	Jan. 4th	Jan. 18th	Feb. 1st	Feb. 15th	Feb. 25th
Lot 1	4th day	47	71	85	85	72	78	76	79	80	78
	7th ,,	83	92	93	96	97	97	97	97	98	97
	10th ,,	94	98	98	98	99	98	98	98	98	98
Lot 2	4th ,,	47	60	82	85	69	87	83	82	80	82
	7th ,,	83	90	95	95	98	98	97	98	98	98
	10th ,,	94	96	97	98	98	98	98	98	98	98
Lot 3	4th ,,	52	80	83	76	64	75	83	88	81	84
	7th ,,	94	95	94	97	98	95	96	97	95	98
	10th ,,	97	98	96	99	99	96	98	98	98	98
Lot 4	4th ,,	52	76	78	70	73	82	80	88	83	81
	7th ,,	94	95	94	98	96	98	98	99	98	98
	10th ,,	97	98	97	99	97	98	98	99	98	99
Lot 6	4th ,,	39	80	85	73	89	89	84	82	83	84
	7th ,,	92	94	95	97	98	98	98	98	98	98
	10th ,,	97	98	97	98	98	99	99	98	98	99
Lot 7	4th ,,	39	79	77	80	71	87	82	81	84	86
	7th ,,	92	95	96	96	98	98	98	98	98	97
	10th ,,	97	99	99	99	99	98	98	98	98	98

DISCUSSION OF RESULTS.

The most interesting features emerging from the results of these trials are :—

The satisfactory maintenance of the germinative power of undried wheat having approximately 18 per cent. moisture over a period of five months in two successive years under good conditions of storage.

The absorbtion of moisture by a bulk of wheat occurred mostly at and near the bulk surface, and, the corollary of this, greater absorbtion of moisture by wheat stored in sacks than by wheat stored in heaps which had relatively smaller surface area.

Although the two latter observations are made on the results of but one season's trial, with confirmation from but a single set of tests of another, they imply, nevertheless, the desirability of the least surface exposure of dry wheat in storage and also, when sampling wheat for moisture tests, of having regard to the possible variations in moisture content of different parts of the bulk and of taking into consideration such variation in the determination of a representative figure for the moisture content of the lot.

The 1943-1944 moisture tests were carried out at the cereal station. Those of the previous trial were done by Messrs. J. H. Bennett, Ltd., Ballinacurra, to whom grateful acknowledgment is made.

WHEAT STORAGE TRIALS AT THE DEPARTMENT'S FARMS, 1943

Investigations as to the effects of different methods of storage on the germination of wheat were continued at the Department's schools at Athenry, Ballyhaise and Clonakilty during the season 1943-44. A report of the work done during the two previous seasons on this subject appeared in Vol. XL No. 2, September, 1943, of this *Journal*.

The methods of storage investigated consisted of keeping the crop in stacks for varying periods before threshing; and after threshing by storing the grain :

(*a*) in untied sacks;

(*b*) in a heap about 2½ feet deep on barn floor and turning it every fortnight on a dry day;

(*c*) kiln drying to a moisture content of about 15 per cent. and treating it subsequently as (*b*).

At each centre an area of three to four acres of a uniform crop of wheat was selected and divided into three fairly equal lots which were as far as possible treated similarly till stacked.

Lot I was threshed shortly after stacking.

Lot II was threshed about nine weeks after stacking.

Lot III was threshed about the end of February.

At the time of stacking a representative sample of grain taken by drawing a handful of ears from at least thirty stooks in each lot selected at random was tested for moisture.

The stacks comprising Lots II and III were securely thatched.

The grain from each lot was sub-divided into three sub-lots and treated as indicated at (*a*), (*b*) and (*c*) above.

At approximately fortnightly intervals samples were drawn from the grain in each sub-lot and tested for germination and for moisture content. The tests for moisture were performed at the Cereal Station, Ballinacurra,

and the germination tests at the schools. The grain comprising sub-lot (c) was forwarded to Messrs. J. H. Bennett, Ltd., The Maltings, Ballinacurra, who kindly arranged for the kiln drying of the various consignments.

A record was kept of the relative humidity throughout the period at each centre. The figures for relative humidity in Tables II to IV are the average of the figures for the date on which the sample of grain was taken and of the two previous days.

Table I shows the variety and dates of reaping, stacking and threshing at each centre.

TABLE I.

Centre	Variety	Date of Reaping	Date of Stacking	Date of Threshing		
				Lot I	Lot II	Lot III
Athenry	Pajbjerg	17/8/43	Lot I 30/9/43 Lot II 11/9/43 Lot III do.	9/11/43	7/12/43	24/2/44
Ballyhaise	April Red	4/9/43	22/9/43	7/10/43	6/12/43	8/2/44
Clonakilty	Diamant	18/8/43	6/9/43	17/9/43	12/11/43	12/2/44

ATHENRY CENTRE.

The crop was healthy, uniform and fully ripe when cut. Weather at harvesting was very unfavourable, stooking could not be done for some days after cutting and hand-stacking in the field was necessary. The grain suffered some damage as a result of adverse conditions. The moisture content of the grain at time of stacking was 22.8 per cent.

Each sub-lot of grain consisted of from 6 to 10 cwts.

When sub-lot II (a) had been in the sacks for about two months it began to heat slightly and had to be spread out on the floor for a few days when it was rebagged.

No germination test was carried out on 23rd November as sub-lot (c) had not then returned after drying. The test conducted on 22nd December did not include sub-lot II (c) which only returned from drying a week later.

Table II gives details of germination and moisture content of each sample and the average relative humidity on the two days previous to and the day of sampling.

The results, in regard to storing in the stack as compared with threshing shortly after stacking and storing in sacks or heaps without kiln drying indicate that the germination is better preserved in the stack though the germination of Lots II (*a*) and (*b*) was lower immediately after threshing than that of Lots I (*a*) and (*b*) at the same date. The period between the threshing of Lots I and II was, however, so short that it is doubtful if the difference in germination should be ascribed to the method of storing. The low germination and the rapid deterioration of Lots II (*a*) and (*b*) are associated with an abnormally high moisture content and are almost certainly due to this factor.

The germination in Lot III immediately after threshing was much higher than that of the corresponding samples in Lots I and II at the same date.

The deterioration in germination was comparatively slow in the undried samples of Lot I while in the corresponding samples in Lots II and III it was rapid—particularly so in Lot III. This feature is associated with a higher moisture content in Samples from Lots II and III than from Lot I and it would seem reasonable to conclude that this high moisture content is the factor responsible for the rapid deterioration of germination.

The outstanding result is the superiority shown by the kiln-dried samples in maintaining the germination throughout the period of storage. The apparent gradual improvement in this respect in Lot II (*c*) however, is difficult to explain. A somewhat similar improvement in some lots in last year's trial was associated with a fall in relative humidity and in moisture content. These factors do not operate in this instance. Neither is there any definite evidence to suggest that the germination is affected by variations in the relative humidity.

The germination figures in columns (*a*) and (*b*) for all three lots suggest that the two methods of storage concerned are of approximately equal merit.

The adverse weather at harvesting resulting in some damage and in the grain having to be stacked with an unduly high moisture content no doubt affected the returns and caused some irregularity in the general trend of the germination figures.

TABLE II.

Athenry Centre.

Lot	Date of Sampling	*Relative Humidity	Germination (per cent.) (a)	(b)	(c)	Moisture (per cent.) (a)	(b)	(c)
Lot I	9/11/43	—	91	93	‡89	21.2	21.0	‡21.1
	7/12/43	93	89	92	97	20.8	21.4	15.3
	22/12/43	93	89	88	96	20.7	21.2	15.6
	4/ 1/44	92	85	80	94	21.0	21.3	16.3
	18/ 1/44	95	84	73	88	21.0	21.5	16.4
	1/ 2/44	93	83	75	94	20.9	21.5	16.5
	15/ 2/44	90	78	70	94	20.9	21.4	16.8
	29/ 2/44	80	76	69	98	20.7	21.0	16.8
	14/ 3/44	85	79	74	100	20.7	20.9	16.7
	28/ 3/44	73	80	69	97	20.3	20.4	16.6
	11/ 4/44	85	72	72	94	20.0	20.2	16.5
	25/ 4/44	81	63	60	90	20.1	20.4	16.6
Lot II	7/12/43	93	81	79	‡79	22.0	22.4	‡23.4
	22/12/43	93	77	85	—	22.9	22.6	—
	4/ 1/44	92	52	70	83	23.1	22.7	15.8
	18/ 1/44	95	57	49	86	23.1	22.8	16.2
	1/ 2/44	93	52	65	90	23.2	22.8	16.9
	15/ 2/44	90	46	52	83	22.6	22.5	16.9
	29/ 2/44	80	59	56	94	22.4	22.2	16.9
	14/ 3/44	85	63	66	83	22.4	22.1	16.8
	28/ 3/44	73	57	57	92	22.2	21.6	16.6
	11/ 4/44	85	58	56	91	21.1	20.8	16.6
	25/ 4/44	81	43	33	96	21.1	20.8	16.6
Lot III	29/ 2/44	80	88	83	‡87	22.0	21.8	‡22.4
	14/ 3/44	85	85	80	89	22.0	21.9	14.9
	28/ 3/44	73	59	73	86	21.7	21.6	15.0
	11/ 4/44	85	45	45	85	21.1	21.0	15.0
	25/ 4/44	81	31	27	81	21.1	20.9	15.0

*Figures for relative humidity are the average of the readings on the date of sampling and the two previous days.

‡Prior to kiln-drying.

BALLYHAISE CENTRE.

At Ballyhaise the crop used in the trial consisted of three acres of April Bearded Red.

The weather after reaping was unfavourable with heavy rain and the wheat was only in fair condition when stacked.

The moisture content of the grain at stacking was 20.3 per cent.

Table III gives the percentage germination and moisture content and the average humidity for the two days previous to and the day of sampling.

The germination results for sub-lots (a) and (b) in Lots I, II and III indicate

a decided advantage from storing in the stack till spring over threshing shortly after stacking. At the end of April, when the investigation ceased, the grain in Lot III (sub-lots (*a*) and (*b*) still showed a satisfactory germination in contrast to that of the corresponding sub-lots of Lots I and II. No explanation is available for the marked deterioration in germination which occurred in the case of Lot II (*c*) subsequent to kiln-drying.

The superiority of kiln-drying is, however, very definitely indicated in Lots I (*c*) and III (*c*).

TABLE III.

BALLYHAISE CENTRE.

Lot	Date of Sampling	*Relative Humidity	Germination (per cent.)			Moisture (per cent.)		
			(*a*)	(*b*)	(*c*)	(*a*)	(*b*)	(*c*)
LOT I	7/10/43	68	96	96	96	19.9	20.6	†20.5
	22/10/43	75	94	94	—	20.1	19.9	—
	9/11/43	67	92	92	96	19.9	20.0	15.6
	23/11/43	67	89	90	94	20.2	20.4	16.3
	7/12/43	67	90	88	95	20.4	20.6	16.6
	21/12/43	57	90	89	94	20.2	20.4	16.9
	4/ 1/44	62	86	87	95	20.4	20.6	18.0
	18/ 1/44	68	82	84	95	19.5	20.6	17.9
	1/ 2/44	76	74	79	75	20.1	20.3	17.3
	14/ 2/44	67	73	77	96	20.1	19.8	18.3
	28/ 2/44	48	71	74	95	19.6	19.3	17.6
	13/ 3/44	61	66	70	96	19.5	19.6	17.4
	27/ 3/44	60	59	66	90	19.1	18.8	17.4
	11/ 4/44	67	57	63	92	18.3	18.2	17.0
	24/ 4/44	70	58	59	89	18.0	18.0	16.8
	1/ 5/44	72	57	59	85	17.5	17.4	16.5
LOT II	19/12/43	66	97	97	†97	19.9	21.4	†20.9
	23/12/43	62	96	96	—	20.0	20.8	—
	7/ 1/44	68	97	97	—	20.8	20.2	—
	14/ 1/44	66	—	—	90	—	—	14.9
	21/ 1/44	58	96	90	84	21.1	20.4	16.0
	1/ 2/44	76	92	91	84	20.0	20.2	17.0
	14/ 2/44	67	86	86	84	20.6	20.1	17.3
	28/ 2/44	48	87	84	81	21.3	20.1	16.8
	13/ 3/44	61	80	83	82	20.6	20.4	17.0
	27/ 3/44	60	76	80	70	19.8	19.8	16.8
	11/ 4/44	67	74	75	65	Z	18.8	Z
	24/ 4/44	70	70	70	63	19.2	Z	16.7
	1/ 5/44	72	69	70	60	18.2	17.1	16.4
LOT III	8/ 2/44	61	96	94	†95	Z	21.8	†21.8
	22/ 2/44	52	93	93	—	20.7	19.8	—
	7/ 3/44	61	90	89	—	20.7	19.9	—
	10/ 3/44	60	—	—	95	—	—	15.3
	21/ 3/44	69	93	91	94	19.9	19.5	15.6
	3/ 4/44	80	92	91	93	19.0	18.9	Z
	17/ 4/41	71	90	90	93	19.1	18.0	16.1
	24/ 4/44	70	88	90	93	17.0	16.7	16.1
	1/ 5/44	72	85	91	93	17.4	17.3	15.5

*Figures for relative humidity are the average of the readings on the date of sampling and the two previous days.
†Prior to kiln-drying.
Z.Sample lost in transit.

CLONAKILTY CENTRE.

At Clonakilty the variety of wheat used for the investigation was Diamant. The crop was fully ripe at harvesting and weather during harvesting was reasonably good so that the grain was stacked in good condition.

The moisture content of the grain at stacking was 19.6 per cent.

The produce of one acre comprised each lot and the quantity of grain in each sub-lot varied from four to 6 cwt.

The grain of sub-lot III (*c*) was unfortunately destroyed by an accident on the way back from being kiln-dried.

Table IV gives the percentage germination, percentage moisture content and average humidity for the two days previous to, and the day of sampling.

The results indicate that except where the grain was kiln-dried there was a gradual deterioration in the germination after threshing but that germinating capacity was fully preserved in the stack. Thus Lot III (*a*) and (*b*) samples tested 96 per cent and 100 per cent. on 16th February as compared with from 42 per cent. to 73 per cent. in the corresponding samples of Lots I and II at that date. In Lots I, II and III the germination of sub-lot (*a*) deteriorated to a greater extent than in the case of sub-lot (*b*). However, in the case of Lots II and III the moisture content of sub-lot (*a*) was consistently higher than in sub-lot (*b*) and consequently it is questionable if the better germination in the (*b*) lots can be taken as indicating superiority in this method of storage.

As at the other centres kiln-dried samples were outstanding in the matter of maintaining germination.

An increase in relative humidity after 5th January is reflected in a rise in moisture content in all samples including those kiln-dried. Actually this period of high relative humidity extended from 8th January till 7th February. After this date the relative humidity fell gradually as did the moisture content of nearly all grain samples. The deterioration in germination, however, was fairly continuous from the beginning and there is no evidence to suggest that it is directly influenced by the humidity of the atmosphere.

TABLE IV.

CLONAKILTY CENTRE.

Lot	Date of Sampling	*Relative Humidity	Germination (per cent.) (a)	(b)	(c)	Moisture (per cent.) (a)	(b)	(c)
LOT I	29/9/43	76	92	88	†100	19	20.4	†19.7
	13/10/43	92	84	87	96	19.5	20.4	16.8
	27/10/43	83	84	83	97	19.3	20.2	16.9
	10/11/43	88	81	84	91	19.4	20.0	17.2
	24/11/43	91	73	79	85	20.0	20.3	17.7
	8/12/43	91	78	82	92	19.9	20.2	17.9
	22/12/43	87	77	73	91	19.6	20.2	17.9
	5/1/44	86	78	72	91	19.7	20.0	17.9
	19/1/44	96	76	73	91	20.1	20.3	18.3
	2/2/44	95	72	70	90	20.1	20.4	18.5
	16/2/44	87	71	73	93	19.9	20.3	18.5
	1/3/44	71	75	76	93	19.7	19.7	18.2
	15/3/44	82	67	71	92	19.7	19.3	17.8
	29/3/44	82	65	75	94	19.4	19.0	17.6
	12/4/44	86	55	67	86	19.5	19.1	17.8
	26/4/44	75	60	68	87	18.5	18.8	17.5
LOT II	24/11/43	91	92	94	†97	21.1	20.4	†20.7
	8/12/43	91	85	97	—	21.2	20.3	—
	22/12/43	87	93	99	98	20.8	20.2	15.4
	5/1/44	86	77	87	90	20.8	20.0	15.7
	19/1/44	96	64	81	90	20.8	20.2	15.9
	2/2/44	95	48	72	98	21.1	20.4	16.4
	16/2/44	87	42	71	94	20.9	20.3	16.7
	1/3/44	71	43	64	96	20.8	19.6	16.7
	15/3/44	82	33	58	89	20.0	—	16.6
	29/3/44	82	36	56	94	19.8	18.3	16.6
	12/4/44	86	27	48	90	19.2	18.9	16.4
	26/4/44	75	26	48	93	19.0	18.5	16.4
LOT III	16/2/44	87	96	100	†89	20.8	20.7	†22.0
	1/3/44	71	95	98	—	20.0	19.3	—
	15/3/44	82	90	88	—	20.3	19.6	—
	29/3/44	82	92	88	—	20.3	19.1	—
	12/4/44	86	70	81	—	19.9	19.1	—
	26/4/44	75	54	81	—	19.5	18.7	—

† Prior to kiln-drying.
* Average of the readings on the date of sampling and the two previous days.

SUMMARY.

Trials have been conducted in 1943-44 at three centres to test the efficacy of different methods of storing wheat as indicated by the germination. These trials were a continuation of trials originated in 1941.

The merits of storing in stacks for different periods and, after threshing, of storing the grain in sacks and in heaps on the granary floor and also of kiln-drying the grain immediately after threshing and storing in heaps were investigated.

Tests for germination and moisture content were conducted at approximately fortnightly intervals on all lots of grain.

The results obtained in these trials confirm those obtained in the two previous seasons and indicate that:

(1) A high standard of germination was maintained so long as the wheat was kept in stacks;

(2) After threshing, the germination of the grain deteriorated gradually, irrespective of the date of threshing;

(3) With the exception of the Clonakilty Centre, there was no marked difference in germination as between grain stored in sacks (sub-lots (*a*)) and grain spread on loft (sub-lots (*b*));

(4) Deterioration in the germination of kiln-dried lots was much slower than where grain was not so dried and at the close of the trial practically all kiln-dried samples still showed a satisfactory germination;

(5) Rapid deterioration of germination in lots not kiln-dried is associated with high moisture content and would appear to be caused by it;

(6) Air humidity does not appear definitely to influence the germination except in so far as it may affect the moisture content of the grain.

THE EFFECT ON SUBSEQUENT EGG PRODUCTION OF THE LEVEL OF FEEDING DURING THE GROWING PULLET STAGE

By

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The effect of a deficiency of an essential mineral or vitamin or of protein in the diet of the pullet during the transition period from the chicken stage to time of egg laying is to retard the development of sexual maturity, and possibly to affect adversely the subsequent egg production of the bird. Very little definite information exists, however, as to the effect of different concentrations of diet *i.e.*, bulky as compared with a concentrated meal or grain mixture, on the age at which egg-laying commences and on the production during the subsequent egg-laying season.

To collect some accurate data on the subject an experiment has been conducted which has given results of such practical significance that their publication is warranted prior to the carrying out of a confirmatory experiment which may take some considerable time to complete. A batch of twelve-and-a-half weeks old wyandotte pullets was divided into four groups containing the following numbers : Group I, 37 ; Group II, 37 ; Group III, 24 ; Group IV, 24. While all pullets were of more or less uniform weight and size, Group I birds were exactly matched with those of Group II, and Group III birds with those of Group IV. Groups I and II had access to grass pens of similar size but Groups III and IV were, from the age of twelve-and-a-half weeks to twenty-eight weeks, each confined to a well-lighted house in which the floor was of wire netting and wooden slats, the floor space per bird being exactly the same in the case of these comparable groups. During the period of fifteen-and-a-half weeks when the birds were growing from the chicken to the sexual maturity stage all four groups were fed on dry mash supplied *ad lib.*, and, in addition, they were given a feed of grain each night at the rate of two ounces per bird. The composition of the mash and the type of grain fed to each group is shown in Table I, which also gives the percentage of fibre in the combination of mash and grain consumed by the respective groups.

All the pullets remained healthy, and, while the appetite of all groups was satisfactory, that of Groups II and IV was keener than that of Groups I and III, this being specially noticeable at the time of feeding grain in the evening.

TABLE 1.

		Group I	Group II	Group III	Group IV
Crushed Oats ..	(parts by weight) ..	—	40	—	40
Wheaten Bran ..	(,, ,,) ..	20	50	10	40
Wheaten Pollard ..	(,, ,,) ..	40	—	40	—
Ground Barley ..	(,, ,,) ..	30	—	30	—
Meat and Bone Meal	(,, ,,) ..	10	10	10	10
Common Salt ..	(,, ,,) ..	1	1	1	1
Alfalfa Meal ..	(,, ,,) ..	—	—	10	10
	Grain	Barley	Oats	Barley	Oats
Percentage of fibre in Mash and Grain diet ..		5.4	9.4	6	10

The average weights of the birds at six and a half months of age and the notes on their appearance and condition which were recorded at the time of weighing, are given in Table 2.

TABLE 2.

	Group I	Group II	Group III	Group IV
Average Weights ..	4 lb.-14 ozs.	5 lb.-1 oz.	4 lb.-11 ozs.	4 lb.-10 ozs.
Appearance and Condition	Birds firm and plump to handle, well conditioned, closely feathered. They appeared slightly smaller than those of Group II.	Birds thin in comparison with those of Group I, loosely feathered. In comparison with Group I thay appeared to carry a larger frame.	Birds well developed, in good condition and firm to handle, closely feathered. In comparison with Group IV they appeared smaller.	Birds in poor condition but appeared to have larger frames than those of Group III. The feathering was loose.

From the age of six-and-a-half months the pullets from the four groups were housed together and fed on a laying diet which was common to all of them and which was constituted as follows: Dry mash, fed *ad lib.* composed of a mixture of:

Wheat Pollard	.. ..	40 parts.
Ground Barley	.. ..	30 ,,
Wheat Bran	.. ..	20 ,,
Meat and Bone Meal	..	10 ,,
Common Salt	.. ..	1 ,,

Grain fed to limit of appetite in the evening and composed of a mixture of:

Barley	..	.. ..	4 parts.
Oats	..	.. ..	1 part.

Limestone, grit, *ad. lib.* In addition all the pullets had free access to a grass run.

Egg production from the individual birds was recorded in the four groups while the pullets were on different diets prior to six-and-a-half months of age, and thenceforward for a period of nine months when the birds were on the common laying diet. The pullets in Groups I and III showed a marked similarity in egg production, and a like similarity in production appeared as between the birds in Groups II and IV. In respect of egg yield Groups I and III are accordingly taken collectively, as also are Groups II and IV. Laying began at an earlier stage among Groups I and III than in Groups II and IV, and at six months of age the total production by Groups I and III was 680 eggs, while Groups II and IV had laid only 456 eggs. By that time, *i.e.*, at six-and-a-half months, 78 per cent. of the birds in Groups I and III had begun to lay, while only 57 per cent. of those in Groups II and IV had started. The average weights of all the eggs laid by Groups I and III and by Groups II and IV prior to six-and-a-half months of age were 43 and 44 grams, respectively.

For the nine months period while the birds were advancing from the age of six-and-a-half to fifteen-and-a-half months of age and during which time they were all fed to a common diet the egg yield was as shown in Table 3.

TABLE 3.

	Average Monthly Egg Production per Bird			
	From Groups I and III		From Groups II and IV	
	No. of eggs	Weight of Egg	No. of eggs	Weight of Egg
6½ to 7½ months ..	16½	45 grams	17½	48¼ grams
7½ ,, 8½ ,, ..	18½	50½ ,,	19½	52½ ,,
8½ ,, 9½ ,, ..	15	52½ ,,	15	52½ ,,
9½ ,, 10½ ,, ..	17½	54 ,,	19½	55½ ,,
10½ ,, 11½ ,, ..	16	57 ,,	18½	57¼ ,,
11½ ,, 12½ ,, ..	18½	59½ ,,	20½	58 ,,
12½ ,, 13½ ,, ..	18½	59¼ ,,	20½	58 ,,
13½ ,, 14½ ,, ..	20½	57½ ,,	20½	57¾ ,,
14½ ,, 15½ ,, ..	20	59¼ ,,	18½	58 ,,

The egg production of the birds in Groups II and IV rapidly reached the level of that from Groups I and III and the figures in Table 3 show that their yield over a period of seven months succeeding the age of six-and-a-half months was, for each month other than the third, actually higher than that of the birds in Groups I and III. The number of birds in each group, however,

was not sufficiently high to warrant a general conclusion to be drawn from the results.

If the diet of the growing pullet includes all the essential nutritive ingredients her frame and her subsequent capability to produce eggs develop at least as well when the diet is of a bulky as when it is of a concentrated nature provided there is no limitation in the quantity of food supplied. A bulky diet, *i.e.*, one in which the fibre reaches 10 per cent., produces a large framed loose-feathered pullet while a comparatively concentrated diet, *i.e.*, where the fibre is limited to 6 per cent. produces a more tightly feathered and better-conditioned bird which, however, is not appreciably weightier than its comrade fed on the bulky diet. The bird reared from twelve-and-a-half weeks old to the egg-laying stage on the more concentrated diet begins to lay earlier in life, and at the age of six-and-a-half months has layed appreciably more eggs than her comrade reared on a more bulky diet. When, however, both birds are put on to a common laying diet comparable in concentration to that of the more concentrated of the diets fed during the pullet-growing stage (and in this experiment the change was made at the age of six-and-a-half months) the egg production of the more backward pullet very rapidly approaches that of the other, and during the subsequent nine months her monthly production is at least as high as that of the birds given the more concentrated diet during the growing stage.

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LEAF ROLL INFECTION IN THE POTATO VARIETIES SKERRY CHAMPION, SHAMROCK AND MATADOR.

By

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Although no potato variety immune to leaf roll has yet been discovered various workers have pointed out that varieties differ greatly in susceptibility under field conditions. Amongst investigators who have commented upon this fact may be mentioned Murphy (6), Whitehead and Currie (10), Loughnane (5), Barton-Wright, Cockerham, and McBain (1), Stevenson *et al* (9). In this country potato inspectors employed by the Department of Agriculture have consistently maintained that leaf roll is scarcely ever seen in some of the older varieties, the two mentioned particularly being Skerry Champion and Shamrock. In a paper entitled "Investigations on the Leaf Roll and Mosaic Diseases of the Potato," Murphy (6) noted both these varieties as being amongst the most resistant to infection in the field. Skerry Champion being recorded under the name of Striped Champion, which is a synonym, as is Buchan Beauty, according to Davidson (4).

Apart from a few small scattered lots, Shamrock is not grown to any extent as a field crop in Éire. In experimental plots, however, where small lots of varieties are under test for wart disease (*Synchytrium endobioticum*), cropping capacity, or maturity, it is frequently used as a buffer variety on account of its distinctive appearance, its resistance to blight (*Phytophthora infestans*) and the fact that it remains green long after other varieties are dead. Experimental plots of this type containing, as they do, a heterogenous collection of plants are invariably nursery beds of all kinds of disease. Nevertheless, when Shamrock is grown in successive years in such plots without change of seed, it is said to show surprisingly little deterioration, whilst British Queen, Up-to-Date, and Kerr's Pink eventually become permeated with leaf roll under the same conditions.

Unlike Shamrock, Skerry Champion is a popular variety extensively cultivated throughout the Midlands, and retained chiefly on account of its excellent quality. Generally speaking, the particular parts of the Midlands where Skerry Champion is grown are not favoured as seed-producing areas, for it has been found that when certified stocks of such varieties as Kerr's Pink and Up-to-Date are introduced into these localities, they frequently

develop 10-20 per cent. leaf roll within two or three years. Obviously, conditions in these districts are suitable for the spread of leaf roll and sources of infection are not lacking. Under the circumstances, the reported freedom from leaf roll of Skerry Champion was a matter of considerable interest and the idea was conceived that Skerry Champion might possibly be a carrier of the virus and hence function as an unsuspected source of infection for other varieties. An investigation was therefore made of the reactions to leaf roll of Skerry Champion and Shamrock, and also of an old continental variety, Matador, which appeared to be of interest in the same connection. The present paper is an account of the results obtained.

ARTIFICIAL INFECTION OF SKERRY CHAMPION AND SHAMROCK WITH LEAF ROLL.

The leaf roll virus cannot be conveyed from one potato plant to another by innoculation of expressed sap, but, as a general rule, is readily transmitted by grafting.

Six plants of Skerry Champion and six of Shamrock were therefore grown in pots in the greenhouse and when 6-8 inches high were top-grafted with potato scions infected with leaf roll. The majority of the grafted plants showed, in due course, primary leaf roll in the axillary shoots, and in the succeeding year the tubers of all units gave rise to plants infected with secondary leaf roll.

The detection of leaf roll in the variety Skerry Champion presented no difficulty. The symptoms of the disease are of the ordinary medium type like those of, say, Great Scot, and consist of a rolling of the lower leaflets accompanied by a pale, pinched appearance in the tops (Fig. 1). The plant, as a whole, is somewhat stunted. In the primary stage of the disease seen in the glasshouse, the tops of the shoots become stiff and erect, the leaflets are chlorotic and reduced in size, and there is a marked development of anthocyanin pigment.

On the other hand, the diagnosis of leaf roll in the variety Shamrock in the field was by no means easy. The main diagnostic feature of the disease, namely rolling of the leaves, is not easily discernible in this variety, or can only be detected at a certain stage. Although in the early stages of growth, the bottom leaves of infected plants become tough and display a slight upward curling of the margins, the latter symptom is short-lived owing to the development of dry blackish lesions on the affected leaves, this being a varietal characteristic and not a disease symptom. These lesions coalesce and the leaves soon wilt and drop : no further rolling occurs (Fig. 2). The chief manner in which diseased plants differ from healthy ones is in their reduced size and slightly chlorotic appearance, especially in the tops. Nevertheless, in spite of

the comparatively mild foliage symptoms, preliminary weighings indicate that the reduction in yield due to the disease is in the neighbourhood of fifty per cent.

It can be seen that artificial infection of Skerry Champion and Shamrock presented no difficulty; although it would appear from the statements of Barton-Wright *et al* (1), that these investigators found some difficulty in transmitting the virus to Shamrock by grafting.

INFECTION OF SKERRY CHAMPION AND SHAMROCK BY MEANS OF APHIDS.

In these tests the experimental tubers of Skerry Champion and Shamrock, and tubers of British Queen infected with leaf roll, were sprouted in moist sand in muslin-covered boxes, and when the sprouts were sufficiently long (usually about ½ inch) they were colonised with aphids from leaf roll sources. The insects were allowed to feed for some weeks, and were then killed by fumigation and the tubers planted.

The preliminary experiments of this kind in 1939 were restricted, owing to the difficulty in procuring tubers of the test varieties. Details of the experiments were as follows :—

Skerry Champion.

1939. Six sprouting tubers were colonised with aphids (*Myzus persicæ*) from leaf roll British Queen and six tubers of President and three of Arran Banner were colonised at the same time as controls. The insects were allowed to feed for one week after which all the experimental tubers were planted in pots in the glasshouse. Four of the Skerry Champion tubers gave rise to plants showing primary leaf roll, while all the Presidents and Arran Banners were infected.

Later in the same year nine more sprouting tubers of Skerry Champion, nine of Golden Wonder and six of President were colonised with *Myzus persicæ* from a leaf roll source. The infestation was heavy and the insects were allowed to feed for four weeks, after which the tubers were planted in the field on June 10th. Owing to the lateness of the season and the proximity of the plants to a hedge, growth of the resulting plants was not altogether satisfactory. One Skerry Champion showed definite symptoms of primary leaf roll and two more were suspicious; the presence of the disease in the latter being confirmed in the succeeding year. Eight of the nine Golden Wonder and five of the six President plants showed leaf roll.

1940. Twenty-four tubers of Skerry Champion and six leaf roll British Queen tubers were sprouted in the same box, and on April 6th were colonised with *Myzus persicæ*. Leaves from a British Queen plant infected with leaf

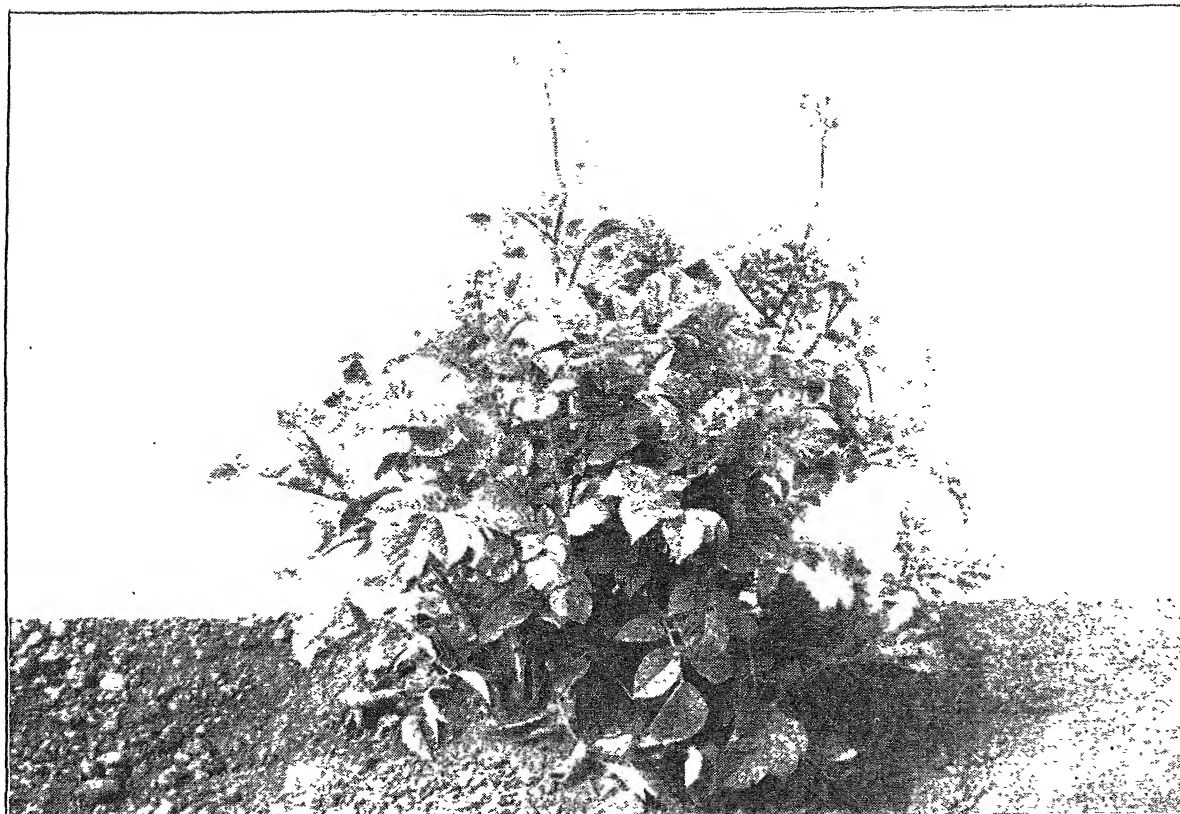

Fig. 1.—Typical Leaf Roll in Skerry Champion.

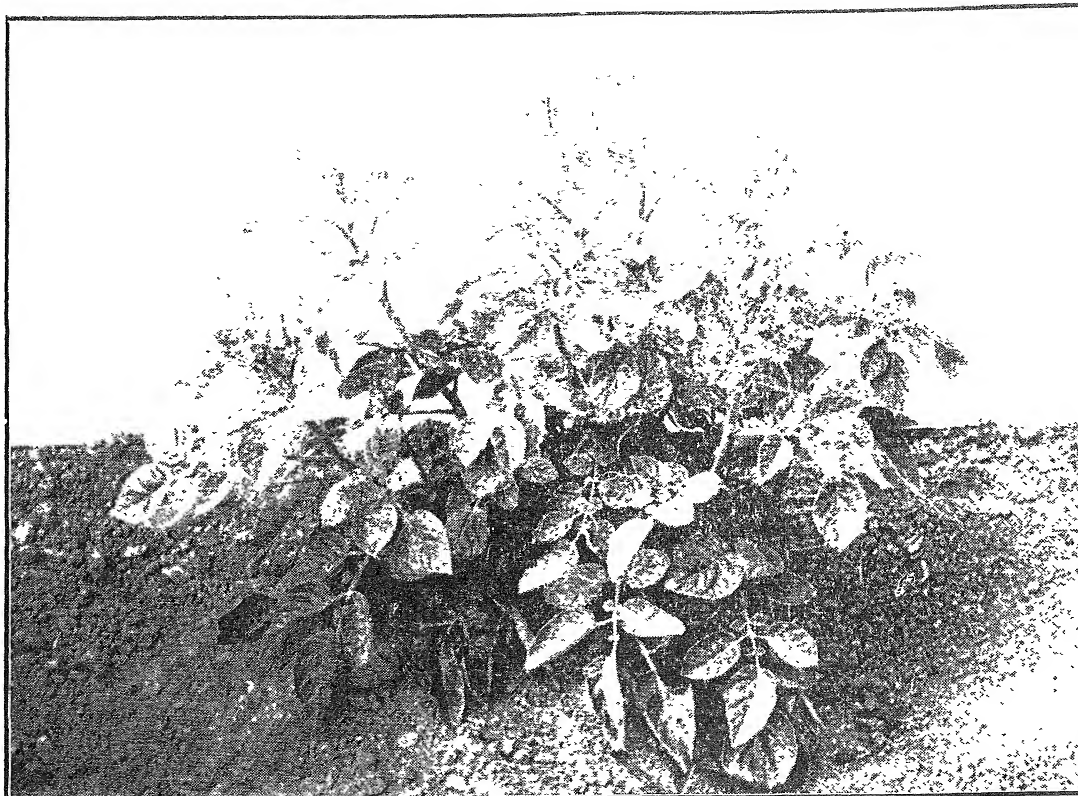

Fig. 2.—Plant of variety Shamrock affected with secondary Leaf Roll : symptoms mild.

roll were enclosed in the box at the same time. The insects multiplied and fed freely and after four weeks were removed by fumigation and the tubers planted in the field. Sixteen of the resulting Skerry Champion plants showed leaf roll, (eight having primary symptoms and eight secondary), the remaining eight appearing normal. The amount of infection was thus about 67 per cent.

1941-1942. In the autumn of 1941 the writers, in company with officials of the Department of Agriculture, inspected in the Midlands a field of potatoes containing Skerry Champion and Up-to-Date growing in adjacent plots. The Up-to-Date plants were badly infected with leaf roll, but careful inspection failed to reveal a single leaf roll plant in Skerry Champion growing alongside. In order to investigate this phenomenon, two tubers from each of forty-eight Skerry Champion plants in the drill adjacent to the Up-to-Date plot were secured at the end of the season, together with a number of tubers from leaf roll Up-to-Date plants. Of the forty-eight Skerry Champion duplicates, one complete set was planted in 1942 in the field at Glasnevin without previous treatment, while the other was submitted to sprout infection with leaf roll beforehand. *Myzus circumflexus* was used as vector and was found to feed just as freely as *Myzus persicæ*. The Up-to-Date tubers were used as sources of infection, in order to cover the possibility that the leaf roll virus occurring in the Midlands might be a different strain from that previously used at Glasnevin. For control purposes, fourteen tubers of the variety President were exposed to infection under the same conditions.

The tubers were colonised on April 20th and planted in the field on May 20th. Of the resulting plants, forty-five of the forty-eight Skerry Champions had leaf roll, and thirty-nine of these showed secondary as well as primary symptoms. Thirteen of the fourteen President plants were infected.

Of the forty-eight Skerry Champions grown without treatment, two adjacent plants showed leaf roll, having apparently contracted infection naturally in the field.

Shamrock.

1939. Five sprouting tubers were colonised with *Myzus persicæ* from a leaf roll source. The sprouts were rather long and the apical leaves hairy, and the insects did not appear to feed freely. After fumigation the tubers were grown in the glasshouse. One plant showed symptoms suggestive of primary leaf roll in the upper leaves but the disease could not be diagnosed with certainty. When the tubers from these plants were grown in the following year, three of the five units were found to be infected with leaf roll.

Later in the same season twelve more tubers were subjected to infection and on this occasion the insects multiplied and fed freely on the sprouts.

Growth of the resulting plants was poor owing to late planting in the field, and only two of the twelve plants were diagnosed as having primary leaf roll.

1940. Twenty-four Shamrock tubers were subjected to sprout infection with *Myzus persicæ* in the manner already described for the 1940 experiment with Skerry Champion. Again it was observed that the insects multiplied and fed freely on the Shamrock sprouts. When the experimental tubers were grown subsequently in the field, twelve of the plants were diagnosed as having primary leaf roll and three more, which appeared suspicious, were shown by grafting tests to be infected. The amount of infection was thus approximately 62 per cent. and this is possibly a minimum figure in view of the difficulty of diagnosing leaf roll in this variety.

The foregoing experiments demonstrated clearly that both Skerry Champion and Shamrock are susceptible to sprout infection with leaf roll by means of aphids.

NATURAL INFECTION OF SKERRY CHAMPION AND SHAMROCK IN THE FIELD.

In this connection reference has already been made to the statements of inspectors regarding the virtual freedom from leaf roll of Skerry Champion and Shamrock. A specific example observed by the writers of the contrast between Skerry Champion and Up-to-Date in regard to leaf roll infection has also been mentioned. In another instance, however, a sample of Skerry Champion received from Co. Tipperary when grown at Glasnevin showed leaf roll in three out of eleven plants, *i.e.*, 27 per cent. From this it was evident that it would be incorrect to state dogmatically that leaf roll does not occur in Skerry Champion in the field, although infected crops are unusual. Considering the ease with which sprout infection takes place, it is perhaps to be expected that occasional stocks would be bound to show disease, if subject to aphid infestation of the sprouts.

In order to test the actual susceptibility of Skerry Champion and Shamrock to natural infection in the field, the following experiments were carried out at Glasnevin. (It may be stated that potato viruses normally spread freely at the latter centre).

1939. Six plants each of Skerry Champion, Shamrock, Arran Cairn, Golden Wonder, President, and Champion were grown in short drills alternating with drills of British Queen infected with leaf roll. During the season none of the Skerry Champion or Shamrock plants showed primary leaf roll symptoms; one of the Skerry Champion tubers failed to grow.

The tubers of all the experimental plants were saved and grown in the following year, when the number of infected units was found to be as follows: Skerry Champion 0/5, Shamrock 1/6, Arran Cairn 5/6, Golden Wonder 5/6, President 5/6. Champion 4/6. Skerry Champion was resistant while Shamrock had contracted almost 17 per cent. infection as compared with approximately 83 per cent. in the more susceptible varieties.

1940. Twenty-four plants of Skerry Champion and twenty-four of Shamrock were grown on either side of a drill of twenty-four British Queen plants infected with leaf roll. The experimental plants appeared normal the first season and were remarkably uniform in size. Four tubers from each of the forty-eight units were planted in the field the following year. None of the Skerry Champion plants showed leaf roll, but one unit (*i.e.*, 2 per cent.) of Shamrock had contracted infection. Unfortunately, a susceptible variety was not included in this experiment.

1941. Forty-eight plants of Shamrock were again grown in the field on either side of a drill of leaf roll British Queen plants. Six tubers from each unit of Shamrock were saved and planted in 1942, but no leaf roll could be detected in any of them. Other varieties however, such as Dunbar Standard and Sharpe's Express, contracted a considerable amount of infection in the same plots in 1941, as was shown when their progeny was planted in 1942.

1942. This experiment was designed to test, in the severest manner possible, the susceptibility of Skerry Champion and Shamrock to infection in the field.

The layout of the experiment was as follows: Drill 1 contained twelve plants of Shamrock grown in alternation with twelve plants of British Queen infected with leaf roll. Drill 2 contained twelve Skerry Champions arranged in a similar manner. Drill 3 was in the nature of a control and contained twelve plants of the susceptible variety President alternating with twelve leaf roll British Queen plants. The fourth drill contained six plants of Skerry Champion and six of Shamrock, each alternating with a leaf roll British Queen Plant. Of the above plants, one Skerry Champion and one Shamrock failed to grow. Six tubers from each of the remaining experimental plants were saved at the end of the season and these were grown in the field in 1943. The number of units in each variety which had contracted leaf roll was as follows: Skerry Champion 1/17 or 6 per cent. Shamrock 6/17 or 35 per cent., and President 11/12 or 92 per cent.

The results of the various experiments on infection of Skerry Champion and Shamrock are summarised in the accompanying Table, the susceptible variety President being included for comparison:—

Variety	Artificial Infection by Stem Grafting		Sprout Infection by Aphids		Natural Infection in Field	
	No. Tested	No. Infected	No. Tested	No. Infected	No. Tested	No. Infected
Skerry Champion ..	6	6 (100%)	87	68 (78%)	46	1 (2%)
Shamrock	6	6 (100%)	41	20 (51%)	95	8 (8%)
President	—	—	26	24 (92%)	18	16 (89%)

LEAF ROLL IN MATADOR

Several continental potato varieties reputed to be of high starch content were introduced into Éire early in the spring of 1939. These importations were made at the request of persons interested in growing potatoes for the production of industrial alcohol. Before being distributed throughout the country, however, the imported tubers were grown in quarantine under the Department of Agriculture, and representative samples of all varieties were tested for the presence of virus diseases at Glasnevin.

Amongst the different viruses present, leaf roll was found to occur to the extent of 8 per cent. in the variety Matador. This variety is at least half a century old, being mentioned in the Report of the Board of Agriculture, London, 1892 (8), where it is recorded as a German variety then introduced into Sweden. As the trend of the disease symptoms in Matador is somewhat unusual it was considered of interest to include the observations made on this variety in the present communication.

On plants grown out-of-doors the disease showed up plainly in the lower leaves when they were about seven weeks old. The affected units were a little stunted, the margins of the lower leaflets being rolled slightly upwards (Fig. 3.) During this phase the plants appeared like those of Up-to-Date or Majestic in process of developing secondary leaf roll. There was, however, a characteristic feature in the case of Matador, namely a pale yellowish-green colour in the terminal leaflet of the lower leaves, which contrasted with the normal green colour of the remainder of the foliage. The presence of abundant starch in these terminal leaflets showed that starch retention occurred just as in the case of typically rolled leaves (7). The rolling of the lower leaves was not progressive as in the case of Up-to-Date or Majestic. On the contrary, by the time the plants were in full flower the previously-rolled leaflets had opened somewhat, and only the margins presented a slight upward curvature (Fig. 4). But the pallid appearance of the terminals of the basal leaves still persisted, and remained the most prominent indication of the diseased condition of the plant. Towards the end of July and throughout the remainder

Fig. 3.—Variety Matador; plant seven weeks old showing secondary Leaf Roll.

Fig. 4.—Leaf Roll Matador plant thirteen weeks old.

of the season the diagnosis of leaf roll in the affected plants would have been difficult except for one acquainted with the behaviour of the disease in this variety. When scions from these plants were grafted on the variety President typical leaf roll symptoms developed in the stocks, (Fig. 5). An examination of the yield of healthy and infected Matador plants over a period of three years showed that, notwithstanding the comparatively mild effect on the tops, the disease caused a reduction in yield of approximately 58 per cent.

DISCUSSION.

Scottish workers, especially Cockerham (3), have studied the resistance of a number of potato varieties to leaf roll. Shamrock is apparently one of the three varieties which Cockerham (3) found to withstand completely intensive conditions of infection to leaf roll in the field and laboratory over a seven year period. His results led him to believe that Shamrock possesses hereditary factors which prevent infection from leaf roll, but that these are several in number and cumulative in effect. In the present investigation both Shamrock and Skerry Champion were readily infected by the artificial method of stem-grafting, and a high percentage of infection was obtained by sprout infection with aphids from leaf roll sources. Neither variety, therefore, is resistant to leaf roll in the same sense as U.S.D.A. Seedling 41956 is resistant to virus X; or in the way that a variety like Arran Crest is field immune to X, namely, because of the intensely necrotic nature of the response evoked by the virus which Cadman (2) has shown to be an heritable factor.

The results obtained at Glasnevin confirm Cockerham's statement regarding the resistance of Shamrock to field infection with leaf roll, while showing that Skerry Champion is superior in this respect. Indeed the latter variety appears to be resistant almost to the point of immunity in the field. No explanation can be put forward at present to account for this resistance. The possibility was considered that insect vectors of the leaf roll virus might be averse to feeding on these varieties. In the sprout infection experiments, however, no antipathy whatever was observed and inspection showed that various insects, including different species of aphids, fed on the adult plants out-of-doors. The fact that virus Y cropped up frequently in the field experiments also showed that aphid vectors were capable of causing virus infection freely in both varieties. The possibility was also examined that previous infection with virus A, which is common in old varieties in this country, might perhaps render plants resistant to natural infection with leaf roll. But it was found that the presence of virus A in no way affected susceptibility to the disease. Incidentally, it is clear that laboratory tests of susceptibility are not always a reliable guide to behaviour in the field, a fact already noted by Stevenson *et al.* (9).

The high degree of resistance shown by Skerry Champion in the field infection tests was in keeping with the statements that crops of this variety seldom have leaf roll. The disease symptoms are of such a nature that they could scarcely be overlooked by any potato inspector. On the other hand, Shamrock (although highly resistant compared to a variety like President) proved to be less resistant than was expected, and it is considered possible that the disease may actually be more prevalent in this variety than is believed, but escapes detection owing to the mild nature of the symptoms produced. It is interesting to note that in Shamrock and in the variety Matador, which is an equally mild reactor, the reduction in yield of tubers due to the disease was considerably greater than one would have expected from the appearance of the tops.

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Fig. 5.—Typical Leaf Roll in President, the result of grafting scions of Matador (Fig. 4) on President.

PIG FEEDING TRIALS WITH LAWN GRASS.

In order to test the value of young grass as a substitute for meal in the ration of fattening pigs, feeding trials were conducted in 1942 at Athenry and Clonakilty Agricultural Schools and in the following year at these two centres and also at the Ballyhaise School.

1942 Trials.

At each centre suitable pigs of 12 to 14 weeks old were selected and divided into two comparable groups. The pigs in Group I were fed to appetite on a meal ration with a small allowance of green cabbage together with half a gallon, approximately, of skim milk per head per day. The pigs in Group II were fed up to 3 lb. per head per day of the same meal mixture together with a quantity of milk similar to that given to Group I and in addition as much lawn grass as they would consume.

The meal ration was made up as follows :—

Barley Meal	6 parts.
Ground Oats	3 parts.
Pollard	1 part.

Owing to the scarcity of pollard the meal ration at Athenry had to be altered as from 8th September to 2 parts barley meal and 1 part ground oats.

The grass, 2 to 3 inches in length, was cut fresh every day or every second day, mixed with the meals and the food given in the form of slop.

Athenry, 1942.

At this centre each group consisted of 7 pigs. During the first week of the trial meal was fed to Group II at the rate of $1\frac{1}{2}$ lb. per head per day. This was increased to 2 lb. for the second and third weeks, to $2\frac{1}{2}$ lb. for the fourth and fifth weeks and to 3 lb. in the sixth week. This rate continued till the end of the trial. By the second week Group I pigs were consuming 3 lb. meal per head per day and from then onward the amount rapidly increased.

Table I shows the average live weights of the pigs in each group at the beginning of the experiment and at approximately fortnightly intervals thereafter also the average of the foods consumed per head by each lot up to the date of weighing.

TABLE I.

Average live weights and foods consumed by Groups I and II at Athenry, 1942.

Date of Weighing	GROUP I					GROUP II				
	Average Live Weight per head	Average quantities of food consumed per head to date of weighing				Average Live Weight per head	Average quantities of foods consumed per head to date of weighing			
		Meal	Cabbage	Milk	Meal* equivalent		Meal	Grass	Milk	Meal equivalent excluding grass
	lb	lb.	lb.	gals.	lb	lb.	lb.	lb.	gals	lb.
2 June, 1942	56.4	—	—	—	—	56.3	—	—	—	—
16 „ „	69.4	35	10	7	47	66 1	21.5	24 5	7	25 6
30 „	83.7	80.5	29	14	106.5	77 1	56	56	14	58.2
14 July „	103 0	136 5	30	21	175	89 3	91.5	92	21	97.8
28 „	121.6	203	40	25	255	101 7	136.5	137 5	28	140 9
18 Aug.,	146.7	311.5	75	37	392 7	114 3	199.5	221.5	37	207.3
1 Sept., „	170.1	392	110	41	473.9	130.3	241.5	288	41	253 7
15 „	195.1	486 5	150	46	581 4	133.7	283.5	363	46	300.2
29 „ „	222.0	584 5	190	51 5	633.2	135 4	325.5	445	51.5	346 6
13 Oct.,	—	—	—	—	—	153 8	367.5	539	58 5	467 0
27 „ „	—	—	—	—	—	161	409 5	639	64	518.3
10 Nov., „	—	—	—	—	—	170 9	451.5	730	70.7	571.7
16 „ „	—	—	—	—	—	180.4	472.5	780	74 2	598.6

*Meal equivalent = Meals + cabbage x [illegible] + milk x 1.7.

The experiment began on 2nd June, 1942, and was continued till 16th November. The health of all animals remained good throughout the period.

The pigs in Group I developed normally and at all times presented a thrifty, healthy appearance. By 29th September they had reached an average live weight of 222 lb. when they were slaughtered.

The pigs in Group II in contrast, were restless and at an early stage developed a dirty scruff on their backs. They were constantly rummaging in their litter which they fouled and were difficult to keep bedded. They showed a distinct preference for the meal part of the ration which they picked out as far as possible before consuming the grass. As will be seen from Table I they had only reached an average live weight of 135.4 lb. at 29th September when Group I was slaughtered at an average weight of 222 lb. During the last few weeks of the experiment the progress of Group II was so slow that on 16th November (by which date also growth of grass had almost stopped) the grass was discontinued and the pigs were fattened off on meals alone.

They were kept on meal ration for 29 days during which period they increased at the rate of 1.16 lb. per head per day indicating that on a suitable ration the pigs were capable of increasing in weight at a reasonable rate.

The curer's report indicated that all pigs in Group I were of first quality while in the case of Group II the fat was soft and spongy.

Clonakilty Centre :

At this centre each group consisted of 6 pigs. The meal ration as at Athenry consisted of :—

Barley Meal 6 parts.
Ground Oats 3 parts.
Pollard 1 part.

This ration was fed *ad lib.* to Group I together with a small allowance of green food and 4 pints of milk per head per day. By 28th September the pigs in this group had reached an average of 252 lb. and were slaughtered. Throughout the experiment they remained healthy and throve normally.

The pigs in Group II received up to 3 lb. per head per day of the meal ration, a milk allowance similar to that of Group I, together with as much fresh lawn grass as they could consume. The grass was taken from the lawns in front of the college and from a field of permanent pasture. The length of the grass varied from 2 to 3 inches. By the fourth week the maximum meal allowance was reached and continued till the end of the experiment. Although the pigs in this group ate their food well they did not behave or thrive as fattening pigs normally do.

They were restless, rather thin with drawn up bellies, staring coats and a general unthrifty appearance, although they remained healthy throughout the period.

On November 16th the grass was discontinued and they were finished on a ration of :

4 parts Barley Meal
2 parts Ground Oats
1 part Soya Bean Meal

fed at the rate of 8 lb. per head daily, together with as much cooked potatoes as they would clear up and the milk allowance as hitherto. During the period from 16th November to the 14th December when they were sent for slaughter they increased in live weight at the rate of 2.71 lb. per head daily indicating that the slow progress during the period on which they were on the ration containing grass was not due to inherent unthriftiness in the animals.

The food consumption per lb. live weight increase was as follows :—

Centre	*Group I*	*Group II*
Athenry	4.2 lb. meal equivalent	4.8 lb. Meal Equivalent + 6.4 lb. grass
Clonakilty	4.6 ,,	4.0 ,, ,, ,, + 6. 8lb. grass

TABLE II.

Average live weights and foods consumed by Groups I and II at Clonakilty, 1942.

Date of Weighing	GROUP I					GROUP II				
	Average Live Weight per head	Average quantities of food consumed per head to date of weighing				Average Live Weight per head	Average quantities of foods consumed per head to date of weighing			
		Meal	Cabbage	Milk	Meal* equivalent		Meal	Grass	Milk	Meal equivalent excluding grass
	lb.	lb.	lb.	gals.	lb.	lb.	lb.	lb.	gals.	lb.
1 June, 1942	57.8	—	—	—	—	57.5	—	—	—	—
7 „ „	66.8	21	1.7	3.5	27.2	61.1	14	7	3.5	20.0
21 „ „	82.8	63	6	10.5	81.5	75	42	21	10.5	59.8
6 July, „	102.7	122.5	11.3	17.5	153.5	94.5	84	38.5	17.5	113.7
20 „ „	124.8	192.5	17.3	24.5	235.6	108.5	126	66.5	24.5	167.6
3 Aug., „	145.8	280.0	24.0	31.5	336.2	121.3	168	105	31.5	221.5
17 „ „	182.0	381.5	31.3	38.5	450.4	137.7	210	168	38.5	275.4
31 „ „	204.2	507.5	39.3	45.5	589.2	154	252	259	45.5	329.3
14 Sept., „	238	647.5	47.3	52.5	742.0	179.7	294	385	52.5	383.2
28 „ „	252	737.5	55.3	59.5	894.7	185.5	336	539	59.5	437.1
12 Oct., „	—	—	—	—	—	193.7	378	693	66.5	491
26 „ „	—	—	—	—	—	208.8	420	847	73.5	544.9
9 Nov., „	—	—	—	—	—	206.5	462	1,001	80.5	598.8
16 „ „	—	—	—	—	—	215.8	483	1,078	84.0	625.8

*Meal Equivalent = Meal + cabbage x ¼ + milk x 1.7.

At both centres the feeding of grass resulted in a much slower rate of live weight increase while at Athenry it resulted in an increased consumption of meals per lb. live weight increase. At Clonakilty there was a slight saving of meals as a result of feeding grass. This amounted to 0.6 lb. per lb. live weight increase of the pigs. This quantity was saved by the feeding of 6.8 lb. grass giving a replacement ratio of 1 : 11.3.

The increased consumption of meals per lb. live weight of Group II over Group I at Athenry was undoubtedly due to the very slow progress made by Group II from mid-September onwards and the greater proportion of the food required in consequence for maintenance. From Table I it will be seen that at 15th September Group II averaged 138.7 lb. live weight having consumed considerably less meal than had Group I at 132 lbs. on 18th August. From mid-September to mid-November Group II pigs increased in live weight by an average of only 41 lb. per head, the meal equivalent consumption for this period per lb. live weight increase being over 7 lb. together with 10 lb. grass.

1943 *Trials*

The trials were repeated in 1943 at Athenry, Ballyhaise and Clonakilty Agricultural Schools. A third group was introduced to discover if the value

of grass for pig feeding from a newly reseeded pasture differed from that of grass from old established pastures.

The basal meal ration consisted of :—
Barley Meal 7 parts
Ground Oats 3 ,,

Group I was fed on this ration according to appetite, together with a small allowance of greens and up to half a gallon of milk per head per day as supplies permitted.

Group II received a maximum of 3 lb. per head per day of the meal ration and an equal allowance of milk to that fed to Group I, together with as much grass cut from an old established pasture as they would consume.

Group III was fed in similar manner to Group II except that the grass was cut from a newly reseeded pasture. The grass in the case of Groups II and III was cut fresh each day and was 2 to 3 inches in length. It was mixed with the meals and fed in the form of slop.

At Ballyhaise each group at the start of the trial consisted of six pigs of comparable quality. At the end of four weeks one pig had to be removed from each group but as these animals were fairly comparable this should not interfere with the value of the results.

The pigs in Group I throve normally and were slaughtered on 26th October having reached an average live weight of 217.6 lb.

About two weeks after going on to the experimental ration the pigs in Group II developed a dirty skin which unthrifty appearance they maintained till the end of the trial. From about the end of the first month they were restless, and appeared dissatisfied with the food and apparently hungry even when they had not cleaned up their trough.

The pigs in Group III were not quite so clean of skin as those in Group I but were much better than those of Group II. They looked fairly normal thriving pigs.

Apart from the difference in depth of fat due to difference in weight there was little difference in quality between the groups on slaughtering. In the case of the Group I animals it was considered that the fat was perhaps a little firmer.

TABLE III.

Average live weights and foods consumed by Groups I, II and III at Ballyhaise, 1943.

Date of Weighing	GROUP I					GROUP II					GROUP III				
	Average Live Weight per head	Average quantities of food consumed per head to date of weighing				Average Live Weight per head	Average quantities of foods consumed per head to date of weighing				Average Live Weight per head	Average quantities of food consumed per head to date of weighing			
		Meal	Cabbage	Milk	Meal* Equivalent		Meal	Grass	Milk	Meal* Equivalent		Meal	Grass	Milk	Meal* Equivalent
	lb.	lb.	lb.	gals.	lb.	lb.	lb.	lb.	gals.	lb.	lb.	lb.	lb.	gals.	lb.
22 June, 1943 ..	79.8	—	—	—	—	79.7	—	—	—	—	79.7	—	—	—	—
6 July, ,, ..	85.0	31	9.3	4.7	40	85.4	18.7	30	4.7	26.7	83.5	18.7	32.7	4.7	26.7
20 ,, ,, ..	89.5	66.3	21	9.3	84.5	89.2	40.3	60	9.3	56.1	84.7	40.3	64.3	9.3	56.1
3 Aug., ,,	106.6	114.3	35	15.3	114.2	93.6	64.3	102	15.3	90.3	98.2	64.3	106.3	15.3	90.3
17 ,, ,, ..	122.2	156.7	53	22.3	200.5	104	90.3	144	22.3	128.2	108	90.3	148.3	22.3	128.2
31 ,, ,, ...	141.4	204.7	71	26.3	257.3	109.6	116.3	208	26.3	161.0	111.3	116.3	212.3	26.3	161.0
14 Spet., ,, ...	165	256.7	91	30.3	318.3	112.4	142.3	268	30.3	194.0	122.6	142.3	272.3	30.3	194.0
28 ,, ,, .	191	316.7	109	34.3	387.1	129.6	170.3	332	34.3	228.8	142.4	170.3	336.3	34.3	228.8
12 Oct., ,, .	208	390.7	129	36.3	466.7	140.4	200.3	402	36.3	262.0	155.2	200.3	406.3	36.3	262.0
26 ,, ,, ..	217.6	456.7	141	38.3	537.5	142	230.3	462	38.3	295.4	161.8	230.3	466.3	38.3	295.4
9 Nov., ,, .	—	—	—	—	—	168.0	272.3	502	40.3	340.8	182.2	272.3	506.3	40.3	340.8
15 ,, ,, ...	—	—	—	—	—	176	290.3	518	40.3	358.7	190.2	290.3	522.3	40.3	358.7

*Meal Equivalent = Meal + cabbage x $\frac{1}{9}$ + milk x 1.7. The value of the grass is not included in the "Meal Equivalent" columns for Groups II and III.

On examination at slaughtering hard lumps of fibre were found in the stomachs of all pigs in Groups II and III. These lumps were larger and more numerous in the case of Group II pigs. In all cases the stomachs were inflamed the inflammation being most severe where most lumps were present.

The average live weights of the pigs in each group at fortnightly intervals together with the average quantities of food consumed to date of weighing are set out in Table III. In the "Meat Equivalent" columns for Group II and III the value of the grass consumed is not included.

At Clonakilty Centre each group consisted of six comparable pigs.

At the end of 8 weeks one pig had to be removed from Group I due to ill health and was replaced by one of comparable weight and age. As the rate of live weight increase was practically the same in all groups up to this point this substitution would not affect the final results materially.

The pigs in Group I were rather poor feeders at first but improved later. Their rate of increase, 1.18 lb. per head per day for the period of the experiment was rather below normal. With the exception mentioned above they remained healthy, and contented and had the appearance of normal fattening pigs. The curer's report was to the effect that four of the group produced good quality carcases but that the fat in the case of the other two was rather soft.

The pigs in Groups II and III throve well till end of August, *i.e.* about 12 weeks after they were put on the trial ration. After this date progress was slower due perhaps to some extent to the fact that the grass had become rather hard and dry. Their general health and appearance remained good till the last few weeks of the trial when they became lanky with staring coats. During the greater part of the period of the trial the pigs in both these groups were restless as compared with Group I and did not sleep as normal fattening pigs do.

The average live weights of the pigs in each group at fortnightly intervals together with the average quantities of foods consumed to date of weighing are set out in Table IV. In the "Meal Equivalent" columns for Groups II and III the value of the grass consumed is not included.

TABLE IV.

Average live weights and foods consumed by Groups I and II, III at Clonakilty, 1943.

Date of Weighing	GROUP I					GROUP II					GROUP III				
	Average Live Weight per head	Average quantities of food consumed per head to date of weighing				Average Live Weight per head	Average quantities of foods consumed per head to date of weighing				Average Live Weight per head	Average quantities of food consumed per head to date of weighing			
		Meal	Cabbage	Milk	Meal* Equivalent		Meal	Grass	Milk	Meal Equivalent excluding grass		Meal	Grass	Milk	Meal Equivalent excluding grass
	lb.	lb.	lb.	gals.	lb.	lb.	lb.	lb.	gals.	lb.	lb.	lb.	lb.	gals.	lb.
2 July, 1943 ..	90.7	—	—	—	..	91	—	—	—	—	91.2	—	—	—	—
6 ,, ,, ..	107.3	42	4.3	7	54.1	99.2	42	10.5	7	53.9	101.5	42	10.5	7	53.9
30 ,, ,, ...	113.2	98	9.4	14	122.8	115.5	84	35	14	107.8	115.5	84	35	14	107.8
13 Aug., ,, ...	124.8	157.5	15.4	21	191.9	127.2	126	73.5	21	161.7	126	126	66.5	21	161.7
27 ,, ,, ...	138.8	220.5	21.7	28	280.5	141.2	168	119	28	215.6	136.5	168	115.5	28	215.6
10 Sept., ,, ...	154	301	29.3	35	363.8	149.3	210	178.5	35	269.5	148.2	210	182	35	269.5
24 ,, ,, .	177.4	395.5	37.0	42	471.0	162.2	252	255	42	323.4	161	252	266	42	323.4
8 Oct., ,, .	206.5	511	45.3	49	603.3	176.2	294	350	49	377.3	169.2	294	367.5	49	377.3
22 ,, ,, ...	227.5	637	54	56	738	190.2	336	458	56	431.2	186.7	336	483	56	431.2
5 Nov., ,, ...	241.4	753.5	61.3	62	865	198.3	378	581	63	485.7	189	378	612.5	63	485.7
3 ,, ,, ..						200.7	432	714	72	551.1	197.2	432	789	72	551.1

*Meal equivalent = Meal + cabbage x $\frac{1}{8}$ + milk x 1.7

The value of the grass is not included in the meal equivalent columns for Groups II and III.

The curer's report on both these groups was as follows: "The pigs were of poor quality with exceedingly thin back fat. They were not at all comparable with your usual run of pigs."

At Athenry each group consisted of seven pigs. They were placed on the experimental ration on 5th July when they were about fifteen weeks old. From 15th September onward milk was not available and was replaced by meat meal at the rate of 10% of the total meal ration. All pigs remained healthy and fed well throughout the trial.

Group I animals throve normally and were sold for slaughter on 2nd November at an average live weight of 212 lb.

During the first five or six weeks of the trial the pigs in Groups II and III maintained a healthy appearance. Later Group II and, to a lesser extent, Group III developed a dirty scruff on their backs, shoulders and ears, which cleared up towards the end of the experiment. Neither of these groups, however, developed into anything better than lean stores. They were sold for slaughter on 3rd January, 1944.

Veterinary examination on slaughtering revealed nothing unusual in the digestive organs.

The curers reported that the pigs in Group I produced sides of good quality with firm dry fat of good colour. In the case of Groups II and III the sides were so thin that in normal circumstances they could have been disposed of to the trade only with difficulty.

The average live weight of the pigs in each group at fortnightly intervals together with the average quantities of foods consumed to date of weighing at this centre are set out in Table V.

TABLE V.

Average live weights and foods consumed by Groups I, II and III at Athenry, 1943.

Date of Weighing	GROUP I: Average Live Weight per head	GROUP I: Average quantities of food consumed per head to date of weighing: Meal	Cabbage	Milk	Meal* Equivalent	GROUP II: Average Live Weight per head	GROUP II: Average quantities of foods consumed per head to date of weighing: Meal	Grass	Milk	Meal Equivalent	GROUP III: Average Live Weight per head	GROUP III: Average quantities of food consumed per head to date of weighing: Meal	Grass	Milk	Meal Equivalent
	lb.	lb.	lb.	gals.	lb.	lb.	lb.	lb.	gals.	lb.	lb.	lb.	lb.	gals.	lb.
5 July, 1943 ...	52.3	—	—	—	—	52.3	—	—	—	—	52.3	—	—	—	—
10 " " ...	66.6	46	12	7	58.5	61.7	25	23.9	7	36.2	61.9	25	23.9	7	36.2
2 Aug., " ...	79.3	95	26	14	120.4	69	56.5	52.4	14	78.9	66.4	56.5	52.4	14	78.9
16 " " ...	98	154.5	46	21	193.2	80.1	95	91	21	128.6	74.6	95	91	21	128.6
6 Sept., " ...	122.4	256.5	86.7	31.5	315.5	96.4	158	161.5	31.5	208.4	91.3	158	161.5	31.5	208.4
20 " " ...	148	329.5	121	35.4	399.5	113.7	200	224.5	35.4	256.6	101.7	200	224.5	35.4	256.6
4 Oct., " ...	175.4	410	161	35.4	481.6	125	242	294.5	35.4	298.6	117.7	242	294.5	35.4	298.6
18 " " ...	192.9	498	201	35.4	577	126.4	284	372.5	35.4	340.6	118	284	372.5	35.4	340.6
2 Nov., " ...	212.4	596	241	35.4	679.4	—	—	—	—	—	—	—	—	—	—
8 " " ...	—	—	—	—	—	137.9	347	515	35.4	403.6	126	347	515	35.4	403.6
22 " " ...	—	—	—	—	—	14[illegible].9	389	613	35.4	445.6	134.7	389	613	35.4	445.6
6 Dec., " ...	—	—	—	—	—	155.1	431	717	35.4	487.6	143.9	431	717	35.4	487.6
20 " " ...	—	—	—	—	—	158	473	821	35.4	529.6	150.9	473	821	35.4	529.6
3 Jan., 1944 ...	—	—	—	—	—	172.6	515	933	35.4	571.6	163.1	515	933	35.4	571.6

*Meal Equivalent = Meal + cabbage x 1/[illegible] + milk x 1.7. The value of the grass is not included in the "Meal Equivalent" columns for Groups II and III.

The percentage of dead to live weight for each group at each centre was as follows :

Centre	*Group I*	*Group II*	*Group III*
Ballyhaise	79	79.5	78.7
Clonakilty	80.1	78.5	77.3
Athenry	74.9	72.5	73.4

The food consumed per lb. live weight increase for each group was as follows :

Centre	*Group I*	*Group II*	*Group III*
Ballyhaise	3.9	3.7 lb. M.E. + 5.4 lb. grass	3.2 lb. M.E. + 4.7 lb. grass
Clonakilty	5.7	5.1 lb. M.E. + 6.9 lb. grass	5.2 lb. M.E. + 7.4 lb. grass
Athenry	4.2	4.8 lb. M.E. + 7.8 lb. grass	5.2 lb M.E. + 8.4 lb. grass

At Ballyhaise and Clonakilty where the rate of live weight increase of the pigs was faster than at Athenry the feeding of grass effected some economy in meals. At Ballyhaise the saving amounted to 1 lb. meal equivalent by feeding 27 lb. grass from permanent pasture or 7 lb. grass from newly reseeded pasture: at Clonakilty the corresponding figures are 11.5 lb. and 12.3 lb. grass per lb. meal equivalent. At Athenry the substitution of meal by grass caused a considerable increase in the meal consumption per lb. live weight increase. This is partly to be explained by the longer period of feeding and very slow progress of Groups II and III as compared with Group I. It will be seen from Table V that even in the early part of the experiment the consumption of meal equivalent was greater for Groups II and III than for Group I for a corresponding live weight increase. Thus on 16th August Group I pigs averaged 98 lb. for a consumption of 193.2 lb. meal equivalent while on 6th September Group II pigs weighed only 96.4 lb. for a consumption of 208 lb. meal equivalent, together with 161.5 lb. grass. This is, however, the only one of the five trials where the feeding of grass did not effect a fairly substantial saving of meals in the early stages and the results from the other four trials suggest that lawn grass might be fed to pigs with advantage in the earlier stages of fattening provided meal formed such a proportion of the ration as to ensure a satisfactory rate of live weight increase.

The pigs referred to in Table V were a somewhat unthrifty lot and although older than either of the lots used at the other two centres were much lighter at the beginning of the trial.

It would appear from these trials that a ration consisting of lawn grass with a maximum of 3 lb. meal per head per day is unsatisfactory for the production of bacon. The progress made by all except one of the grass-fed groups in the early stages, however, indicates that grass may with advantage be substituted for meals provided it does not form too great a proportion of the ration.

Due to the unsatisfactory nature of the ration as a whole no reliable conclusion can be drawn from the results as to the relative value of old pasture grass and newly reseeded pasture grass for fattening pigs.

A SUMMARY OF RESEARCH WORK CARRIED OUT IN IRELAND ON THE POTATO ROOT EELWORM.

By

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Research on the potato root eelworm was begun in the Agricultural Zoology Department of University College, Dublin, in 1930 and has continued up to the present time. An attempt to summarise in a brief fashion all the work which has been done during this long period is now made in the present paper. Details of different phases of the research have been published from time to time in the Journal of the Department of Agriculture and in the Journal of Helminthology. Reference to certain aspects of the work is now made for the first time.

Incidence of the eelworm in Ireland.

It is now known that the potato root eelworm has a wide-spread distribution throughout Ireland. It occurs abundantly in many regions around the coast and in Islands off the west coast, particularly in the light sandy areas. There are also many records of it from widely dispersed inland regions especially from small gardens where potatoes have been cultivated intensively year after year for many years. It has also been found in areas of cut away peat bog (where potatoes were being cultivated) in the midlands.

Extent of Knowledge concerning the eelworm prior to 1930.

Previous to 1930 (when the research work described in this paper commenced) very little fundamental research had been done on the potato root eelworm. At the outset it would be well to state briefly what was known about the eelworm at that time. It was known that the presence of eelworm in the soil was very often associated with failure of the potato crop resulting from a condition known vaguely as "potato sickness." There were conflicting opinions as to whether or not the eelworm was entirely responsible for this "sickness" and failure. Some held the view that the eelworm was the sole cause of the trouble. Others suggested that the eelworm might be only a contributory cause—that other factors such as the presence of fungi or unfavourable physical or chemical soil conditions might be contributory causes or indeed, major causes. Those with the latter view based their arguments chiefly on the fact that sometimes very good, vigorous, highly-productive plants might be found with an abundance of eelworm cysts on the roots. The roots of these plants had, of course, been invaded earlier in the season by numerous eelworms which completed their development in the roots and yet the plants had apparently suffered no ill effects.

It was also known that the eelworm eggs in the cysts occurring in the soil would not hatch unless they were stimulated to do so by excretions coming

from the roots of growing potatoes, and further, it was known that in the absence of a potato crop (which meant, of course, absence of potato root excretions) the eggs could remain unhatched, but in a viable condition, for a long time in the soil. The fact that the eggs could remain alive in the soil for long periods meant that an infected area would not be safe for potato growing until these eggs (or at least the bulk of them) had died off or disintegrated, but there was no accurate information as to how many years would have to elapse before infection died out naturally in the soil. There was little information as to whether or not infection would die out more rapidly under one method of land utilisation than under another method and little research had been done on the problem of controlling the parasite.

Research on the real significance of the eelworm in the soil.

The first problem which the authors set themselves to investigate was whether the eelworm was the sole cause of the well-known "potato sickness" or whether it was only a contributing cause or an ever present factor of little or no importance.

There were three avenues of approach to this investigation, *viz:*

(*a*) To ascertain the effect of adding eelworm infection to soil which had never before within living memory grown potatoes;

(*b*) To ascertain the effect of removing the eelworm factor only from naturally "potato sick" soil by sieving the soil so as to remove the eelworm cysts;

(*c*) To ascertain the effect of removing both the eelworm factor and fungus infection factor from naturally "potato sick" soil by steam sterilization of the soil.

Experiments under heading (a).

The soil which had never previously grown potatoes was taken from a grass field and in its natural condition was found capable of growing perfectly healthy, vigorous, productive potato plants. When a number of cysts, representing a light infection of eelworm was added to this soil the plants which it then grew were less healthy and less productive. By adding a greater number of cysts the plants grown were still poorer and when a still greater number of cysts were added (a number representing a moderately heavy infection of eelworm) the plants grown were very poor and their yield of tubers was practically nil. They looked as if they had grown on very bad "potato sick" soil. In this case, therefore, a soil which was capable of growing healthy potatoes and which, apparently, had no harmful fungi and no adverse chemical or physical characters was artificially brought into a typical "potato sick" condition by just adding eelworms (as cysts).

Experiments under heading (b).

The potato plants which this soil was capable of growing in its natural condition were very poor, exhibiting all the characters of bad "potato sickness." The soil was sieved through a sieve sufficiently fine to hold back eelworm cysts of all sizes except, perhaps, a very small number of the very smallest cysts. Possibly also, a limited number of eggs which had come out

of broken cysts went through the sieve. The sieving did not, of course, remove fungus organisms and did not alter radically the chemical nature of the soil which passed through. The fine sieved soil was restored to something like its original degree of coarseness by the addition of some sterilized silver sand and potatoes were then planted in it. The plants which grew were quite normal in appearance being very healthy and vigorous and yielding well. Very few eelworm cysts were found on the roots at the end of the growing season. This experiment demonstrated that the typical "potato sickness" could be completely obviated by removing the eelworm factor only, without removing any fungi which might be present or altering the chemical character of the soil.

Experiments under heading (c).

Typical "potato sick" soil was again used for these experiments as for the experiments under (*b*). The soil was steam sterilized, which sterilization killed all the eelworm eggs and fungus organisms. The effect of the sterilization on the chemical and physical characters of the soil was not investigated. Shortly after the soil had been sterilized, potatoes were planted, in one portion to which no eelworm cysts had been added after sterilization, and in other portions to which varying numbers of cysts had been added. The potato plants which grew in all these portions of sterilized soil (irrespective of whether cysts were added or not) were quite normal, very healthy and very productive. Nevertheless, at the end of the growing season eelworm cysts were found on the roots of those plants growing in soil to which cysts had been added after sterilization. These cysts were particularly abundant on the roots of plants growing in soil to which a relatively large number of cysts had been added. Here, therefore, was the still unexplained occurrence—sometimes found also in the field—of very healthy productive plants having an abundance of cysts on the roots. The question arising from these experiments was : "Why did the eelworms which were added (as cysts) to this sterilized soil not produce 'potato sickness'?"

Experiments to investigate the possible effects of sterilization on the hatching of eelworm eggs in cysts added to soil subsequent to sterilization.

In seeking an answer to the foregoing question the authors surmised that the sterilization of the soil might have had some effect on the hatching of the eggs in the cysts which were added to the soil after sterilization. They argued that if any such effect was operative, it might operate only in soil which had been recently sterilized and might cease to be operative if a certain length of time elapsed between sterilization of the soil and subsequent planting of potatoes in it. Accordingly, a new series of experiments was planned to obtain precise data concerning the hatching of eelworm eggs.

A number of portions of soil were steam sterilized at intervals of six weeks from September on to the following April. In this summary the authors confine their remarks to three of these portions, *viz.*, one sterilized in September, the second the following December and the third the following April. In April, just subsequent to the last sterilization, a potato tuber was set to grow in a pot of each portion of sterilized soil and the drainage from each pot (containing

of course, the root excretions) was continuously collected. Laboratory Experiments on the hatching of eelworm eggs in different lots of cysts were then commenced. For three lots of cysts the drainage from the three named pots of sterilized soil was used as the hatching medium. For another lot of cysts drainage from a pot containing a potato growing in unsterilized soil was used as the hatching medium and for still another lot of cysts ordinary tap water was used. The results of this experiment were very interesting. The eggs in the cysts placed in drainage from pot of unsterilized soil commenced to hatch after about five days (normal time) and proceeded to hatch in normal manner over a period of about 35 days so that hatching was complete in 40 days. The eggs in cysts placed in drainage from pot of soil sterilized seven months previously (in September) also hatched in perfectly normal manner and time like those in the previous control lot. The eggs in the cysts placed in drainage from pot of soil sterilized four months previously (in December) did not commence to hatch to any appreciable degree until after a lapse of about 8 days, *i.e.*, about 3 days later than normal, and after hatching commenced it proceeded at a slower rate than normal, taking about 60 days to reach completion. The eggs in the cysts placed in drainage from pot of soil recently sterilized (in April) did not commence to hatch to any appreciable degree until after a lapse of about 30 days, *i.e.*, about 25 days later than normal and hatching took about 80 days to reach completion.

Only a very small number of the eggs in the cysts placed in tap water hatched out.

This experiment, therefore, proved the correctness of the authors' speculation that sterilization of the soil might have some effect on the hatching of eelworm eggs and that such effect was operative to full extent only in recently sterilized soil. It also gave the clue as to the reason why perfectly healthy looking potato plants are sometimes found with an abundance of eelworm cysts on the roots.

The next experiment was to follow the clue from the previous experiment and for it the same lots of sterilized soil were used. Some potatoes were planted in each lot of soil, but, before planting, the soil in each case was inoculated with a sufficient number of cysts to give a moderately heavy infection of eelworm. The results were; (a) Potatoes in soil sterilized seven months previously showed all the typical symptoms of bad "potato sickness." (b) Potatoes planted in soil sterilized four months previously were moderately good but nevertheless showed obvious symptoms of "potato sickness" and yield was depressed. (c) Potatoes planted in soil sterilised just before planting time were exceptionally good in appearance and yield but, nevertheless, had an abundance of cysts on the roots at the end of the growing season.

The next experiment was to verify beyond all doubt the assumption which was now obvious. Sprouted potatoes were planted in two portions of unsterilized eelworm-free soil, the intention being to add subsequently to each portion of soil, eelworm larvae hatched out artificially in the laboratory from two equal (in weight) lots of cysts. Each lot of cysts was sufficiently

large to produce sufficient larvae to give a moderately high eelworm infection to each portion of soil. Addition of larvae to the first portion of soil was commenced five days after the tubers were planted, *i.e.*, just when they would normally commence to hatch in the soil if cysts had been present. Addition of larvae to the second portion of soil did not commence until 30 days after the tubers had been planted (by which time the young plants were moderately well grown). The potatoes in the first portion of soil commenced to develop typical symptoms of "potato sickness" shortly after the addition of larvae commenced and as the season progressed, such symptoms became more and more pronounced.

The potatoes in the second portion of soil never developed symptoms of "potato sickness" but at the end of the growing season had an abundance of cysts on the roots.

The above experiments had, therefore, succeeded in demonstrating that the potato root eelworm can and does by itself produce the typical well-known "potato sickness" but unless the eelworms start hatching naturally in the soil almost immediataly after the newly planted tubers commence to send out roots then the symptoms of "potato sickness" do not develop. The plants can be quite vigorous and the yield good despite a delayed attack of potato root eelworm. In other words, if, for any reason whatsoever, young potato plants make some growth and develop a fair root system before the eelworms commence hatching and entering the roots a satisfactory crop can be obtained, even if there is a high degree of eelworm infection in the soil. This explains why early potatoes often escape obvious damage on land known to be "potato sick" because such potatoes are usually planted very early in the season when the soil temperature is not yet sufficiently high to induce normal hatching of eelworm eggs. It also explains the desirability of using good, vigorous "seed" potatoes, of using fertilizers liberally and of using sprouted "seed" potatoes —all these being factors encouraging quick growth and root development of the young potato plants and giving them a chance to become established before normal rapid hatching of eelworm commences.

Having established experimentally that the root eelworm is the definite cause of the well-known "potato sickness" the authors proceeded to carry out a protracted series of experiments on the pest.

Hydrogen Ion Concentration of the Soil.

Early in the experiments it was demonstrated that no relationship exists between the hydrogen ion concentration of the soil and the incidence of eelworm infection.

Relationship between intensity of "potato sickness" and cyst content of the soil.

Efforts were made to correlate the intensity of "potato sickness" with the number of cysts present in the soil. As a result of experiments the authors found that "potato sickness" in its most severe form became manifest if 3 cysts per c.c. were added to soil known to be free of eelworm infection. When the number of cysts thus added fell below this figure the severity of the disease became progressively less according as the number of cysts added diminished.

Above 3 cysts per c.c. of soil there was no correlationship between intensity of the disease and the number of cysts present.

Many other research workers have endeavoured to correlate the number of cysts in the soil (cyst count) with the intensity of "potato sickness" and on the whole have not been able to arrive at such a definite conclusion as the present authors. Many workers, indeed, have failed to establish any such relationship. These workers have, however, based their conclusions entirely on figures obtained by counting the total number of cysts of all kinds isolated from samples of soil being investigated. Such cysts may be very variable in age and size and, moreover, may differ widely as regards egg contents. Some of them may still have a fairly full complement of viable eggs while varying proportions of the eggs in others may be dead and, indeed, some of the cysts may contain few or no viable eggs. One could not expect to be able to correlate the number of such miscellaneous cysts found in the soil with the intensity of "potato sickness."

The present authors did not attempt to correlate the number of cysts actually found in the soil with the disease symptoms. The conclusions arrived at were based entirely on the results obtained by adding fresh cysts, taken directly from the roots of the previous season's potato plants, with a full complement of viable eggs, to soil which was known to have been previously free of cysts. The majority of the cysts thus used were of moderately good size, the average content of viable eggs being in the neighbourhood of 200 to 250.

In order to remove ambiguity the authors now modify their previous statement and substitute instead a statement based on the number of viable eggs (in cysts) in the soil. This statement would be that the intensity of "potato sickness" symptoms has a direct relationship to the number of viable eelworm eggs in the soil when this number is less than about 600 to 800 eggs per c.c. of soil. The approximate figure of 600 to 800 eggs per c.c. of soil can produce "potato sickness" in its most severe form and consequently, above this figure, a correlationship between egg numbers and intensity of disease cannot exist. "Potato sickness" in its most severe form does not, however, always manifest itself when 600 to 800 eggs per c.c. of soil are present.

Multiplication of eelworm populations in the soil.

The authors collected much data from their experiments concerning the rate at which eelworm populations in the soil can undergo change consequent on the continuous growing of potatoes. If one starts from a point when the soil has a very low population and puts in a crop of potatoes the result after growing such one crop is that the eelworm population is multiplied very greatly (perhaps many hundred times). If successive crops of potatoes are planted the population still continues to increase each year but at a successively slower rate until the time comes when there is a sufficiently large number of eelworms to cause "potato sickness" in its most severe form. Such state may be reached in a small number of years and, when reached, the growing of a further crop of potatoes may not increase the eelworm population any further. The plants are then so bad, particularly as regards root development, that they can only maintain a fraction of the eelworms which hatch and as a

consequence, the eelworm population of the soil (expressed as viable eggs per c.c.) at the end of the growing season may be considerably less than it was before planting time.

Dying out of eelworm populations in the soil.

The authors have not carried out any detailed experiments to determine the rate at which eelworm infection in the soil diminishes but they have had the opportunity of observing the effect of leaving eelworm infested ground without potatoes for some years. From this observation it appears that infection will diminish at a more rapid rate if soil is being cultivated each year for arable crops rather than if it has been laid down to grass. These observations are based entirely on the degree of "potato sickness" evincing itself in the first crop of potatoes grown after the land has been without potatoes for some years.

From results of research carried out by other investigators it appears that if "potato sickness" has been severe in an area an interval of about six years is necessary before a satisfactory crop of potatoes can be grown again. Even at the end of such interval some degree of infection may still remain and the growing of a potato crop. will multiply the infection, possibly to a high degree. The position, therefore, is that in any field where "potato sickness" has been severe a satisfactory crop of potatoes can be raised only once about every six years.

Efforts to stimulate the hatching of eelworm eggs.

Knowing the power possessed by the root excretions of the potato plant to induce the hatching of eelworms eggs the authors wondered whether sap extracted from the stalks and leaves of potatoes or from the stalks and leaves of the tomato plant (another member of the *Order Solanaceae*) would have any power to stimulate hatching. A series of experiments were carried out to test such possibility but the results were entirely negative.

Various investigators have sought for some substance of a chemical nature to stimulate hatching of the eggs but, up to the present, their efforts have not been crowned with much success. There does not appear to be any immediate prospect of discovering anything sufficiently cheap to be economical, which, when added to the soil, would induce hatching of eelworm eggs. The finding of a substance of this nature would be an ideal solution to the eelworm problem for then, in the absence of a potato crop the eggs in the soil could be induced to hatch and for want of a proper host plant the young worms would die.

Experiments with substances to use as soil dressings for the control of potato eelworm.

As one would naturally expect many research workers have sought for some substance which, if used as a soil dressing, would control the potato eelworm. The present authors have designed many experiments with this object in view. They have written up the results of some of these experiments and have left unwritten the results of others. At one time the results of investigations by a research worker in Britain gave hope that creosote salts (*i.e.*,

crude naphthalene) might be a useful soil dressing. At another time great hope was placed in the possible usefulness of calcium chloracetate. After prolonged tests on these substances the present authors finally abandoned hope for their usefulness. At one time the authors got an idea that the presence of iron oxide in the soil might have an inhibiting or control effect on eelworm. Following this clue they laid down an extensive series of experiments to test not alone iron oxides but the oxides of most of the other metals. The results of these experiments were completely negative. Other substances tested, also with negative results, were naphthalene, parà-di-chlorbenzene, cresylic acid emulsion, carbon bisulphide, copper sulphate, potassium permaganate, derris powder, pyrethrum powder and nicotine sulphate.

Calcium cyanamide used as a soil dressing at the rate of 1 ton to 2 tons per acre does give a measure of control and often enables the growing of a moderately good crop of potatoes in land having a big eelworm population. The improvement in growth of the plants is probably however, due in great measure to the fertilising effect of the dressing which is a recognised nitrogenous fertiliser. In any case the application of such a heavy dressing of calcium cyanamide represents a heavy expense per acre and, although a moderately good potato crop may be secured, there is little or no reduction in the actual eelworm population of the soil.

Experiments on trap cropping with potatoes as a possible means of controlling potato eelworm.

The ideal way to eliminate potato eelworm from the soil would be to stimulate all the eelworm eggs in the soil to hatch during a season in which no potato crop is being grown. It has already been stated that little progress has been made towards this end by the use of chemicals and so the question will be asked : "can potato root excretion itself be used for this purpose?"

To investigate this possibility the authors embarked upon and carried out a prolonged programme of experiments. The main idea underlying the experiments was to plant potato tubers in an area containing eelworm infection ; to allow the plants coming from these tubers to grow for a certain length of time so as to induce hatching of the eggs, and then to remove these plants before any of the eelworms which hatched had time to complete their development. After a prolonged series of detailed experiments it was discovered that if sprouted tubers are thus planted the plants must be removed five weeks after planting in the case of an April planting and four weeks after planting in the case of a May planting. It was further demonstrated that it was not necessary to remove all the roots as eelworms in any roots left behind will die before completing their development. A further degree of elimination of eelworm from the soil could be secured by double trap cropping, *i.e.*, by planting a second lot of tubers immediately after removal of the first plants, but if this is done the second lot of plants would have to be removed three weeks after planting the tubers which produced them on account of the fact that larvae are still actually hatching at the time when the second lot of tubers are planted. Many other detailed points were elucidated in preliminary experiments and when all such preliminary data was obtained a series of ex-

periments was designed to put this possible system of control to a practical test.

The first year's experiments were carried out in a large number of pots and in some small plots measuring 8′ x 4′ encased with boards. In the plots the tubers were planted close—one foot apart each way. Both the single system and the double system of trap cropping were put to test. After the plants of the trap crop were removed the soil was kept free of weeds until the following season. The results of these preliminary experiments in pots and small plots were entirely satisfactory—a very good measure of control of the eelworm was secured even by the single trap crop system.

The following year, and the year after, the system was put to test in a series of field plots measuring 10′ x 8′ laid down in chess board fashion in an area where a uniformly heavy infection of eelworm was known to exist. The tubers were set one foot apart in lines two feet apart. Contrary to expectations the degree of control secured was very disappointing. The plants growing in the plots which had been trap cropped the previous year (both single and double system) were on the whole not much better than the plants in the control untrapped plots. It was thought that such disappointing result might have been due to the plots being so small that an unduly large amount of soil might, in many accidental ways, have passed from one plot to another in the series and thus spread sufficient infection from control to trap cropped plots.

In order to reduce this possibility to a minimum and put the system to a bigger test the same experiment was repeated in subsequent years on a much larger adjacent area where a fairly uniform degree of eelworm was known to exist. The plots were now five yards square and were again laid down in chess board fashion. Again in this larger scale experiment the results were very disappointing and the conclusion had to be that trap cropping does not give a satisfactory measure of control when practised under field conditions. The reason for this must be that in the year of trap cropping only a certain proportion of the eelworm eggs are induced to hatch leaving possibly a high proportion available for hatching in the next year. In the pots and in the very small plots where the potatoes were planted very close together the potato roots were in such a restricted amount of soil that the excretions could reach all the cysts. It is likely that in the field plots where the potatoes were planted more sparsely and where there was greater depth of soil many cysts were beyond the limits to which the excretions permeated.

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THE HERRING FISHERY IN ÉIRE, 1921-1941

By

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In the following pages an attempt has been made to give a concise summary of the herring fishery in the years from 1921 to 1941, or approximately the period between the two European wars. The abnormal conditions in 1914-1918 were prolonged locally by disorganised transport and generally unsettled conditions until 1923 but, except for increased demand for herrings for export, higher prices and the absence of English and Scottish boats from our shores, the years 1940 and 1941 did not differ markedly from the preceeding period.

The arrangement here adopted is to take in succession round the coast, beginning at Carlingford Lough, each of the areas in which herring fishing is carried on under uniform conditions, whether on a large or small scale. For each area two graphs are given, one showing the percentage distribution of the total catch for the area in each year of the period 1921-41, and the other the average percentage of the catch taken in each month of the year.

The total catches during the period under review in the various areas differ enormously, varying from six thousand cwt. on the coast of Clare to over half a million cwt. on the north coast of Donegal. The areas adopted and the total catches in each of them are shown in the accompanying map and diagram (Figs. 1 and 2).

Fig. 3 shows the total landings for each year during 1921-1941 as percentages of the total catch during that period. The actual quantities in cwts. landed each year in each of the areas are given in Table I.

Another diagram (Fig. 3 inset) shows the average catch in each month for the whole of this country. From this it can be seen that herrings in larger or smaller quantities are usually available in every month of the year except March and that in the months of May and June the supply far exceeds that for any other period. This graph takes into account the presence of English and Scottish steam drifters whose attendance cannot be regarded as certain, as it is dependant on a number of incalculable factors such as the European demand for pickled herrings and the productivity of other fisheries outside Irish waters.

The main sources of these monthly supplies are given below but, owing

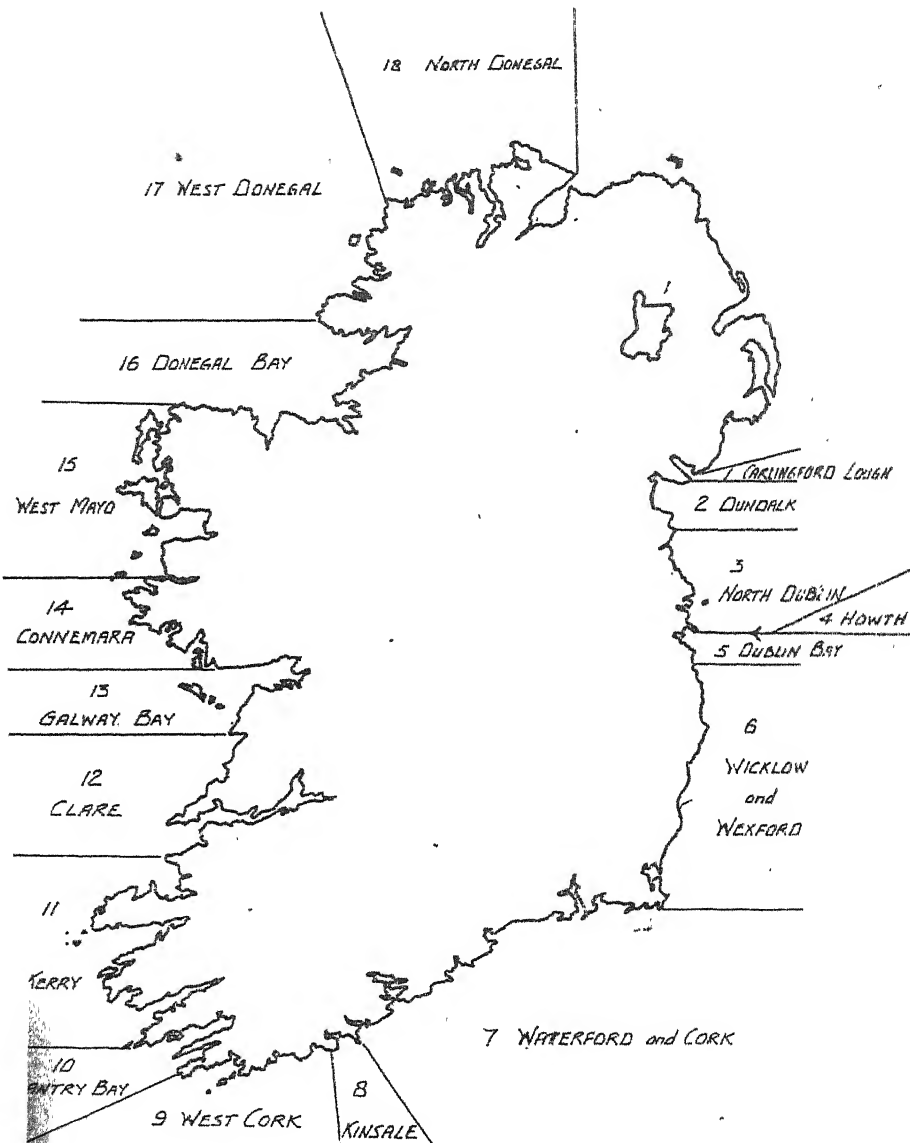

Fig. 1.—Map showing the landing areas adopted in the paper.

TABLE I.

Landings of Herrings, in hundredweights, each year on the coast of Éire from 1921 to 1941.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	Carling-ford	Dundalk	North Dublin	Howth	Dublin Bay	Wicklow and Wexford	Water-ford and B. Cork	Kinsale	West Cork	Bantry Bay	Kerry	Clare	Galway Bay	Conne-mara	West Mayo	Donegal Bay	West Donega	North Donegal
1921 ...	—	2,488	3,960	27,772	556	269	12,508	5,291	2,577	4,777	781	557	6,483	2,911	1,763	2,766	8,024	27,751
1922 ...	295	975	2,155	26,272	1,212	23,169	14,358	7,229	5,173	1,671	1,382	662	1,199	2,509	3,182	3,428	9,981	7,589
1923 ...	525	1,020	967	38,214	3,397	12,924	13,793	7,877	1,752	586	2,562	1,156	1,073	325	540	2,812	5,185	5,666
1924 ...	876	3,285	97	40,702	630	9,003	23,963	9,833	9,683	1,842	3,499	116	2,374	3,568	612	5,429	12,600	9,822
1925 ...	252	2,539	483	63,408	425	13,652	31,327	2,407	8,813	4,182	4,111	27	1,240	1,308	116	394	7,164	48,781
1926 ...	4,250	6,956	2,580	69,907	2,043	61,875	55,931	23,039	9,255	4,334	3,402	18	5,766	1,676	2,284	3,353	8,950	54,803
1927 ...	—	244	8,480	27,041	8,379	12,350	49,601	54,427	11,352	3,649	3,603	19	3,285	941	289	4,894	24,817	122,808
1928 ...	2,250	435	1,629	10,989	5,598	11,309	19,889	8,546	5,399	534	2,296	17	3,117	203	1,530	53,305	39,015	114,435
1929 ...	1,125	518	492	4,911	1,440	4,617	2,073	6,216	1,126	1,613	1,551	6	2,654	100	216	23,398	13,945	73,957
1930 ...	955	1,706	1,341	5,977	418	19,854	6,178	5,996	8,071	1,669	1,495	130	2,410	182	44	12,072	15,637	29,346
1931 ...	184	567	752	4,096	540	14,555	2,330	2,372	6,207	2,792	1,678	42	2,307	29	130	8,207	13,888	10,332
1932 ...	100	484	1,169	2,999	3,552	5,635	2,369	3,896	1,731	618	1,187	77	348	27	262	880	12,068	2,156
1933 ...	1,115	372	145	3,230	5,962	11,638	4,177	1,372	2,877	1,712	347	256	1,283	—	1,392	4,765	2,572	9,377
1934 ...	800	167	912	3,682	10,786	5,553	3,731	1,075	1,402	762	97	22	1,000	—	784	2,679	31	3,545
1935 ...	757	824	513	6,802	10,476	13,678	4,560	1,490	285	411	481	183	1,104	11	607	5,711	5,982	10,696
1936 ...	202	67	427	5,758	595	5,247	7,782	1,905	631	1,070	1,061	220	4,045	32	727	8,711	10,433	13,555
1937 ...	820	202	180	8,641	185	9,062	5,157	3,024	933	386	1,046	538	2,187	53	205	3,404	9,918	19,814
1938 ...	1,138	281	—	3,243	1,438	5,813	5,123	2,031	477	316	1,019	1,671	1,490	37	286	11,375	12,400	8,098
1939 ...	687	376	250	4,193	87	3,414	5,241	1,487	383	272	3,300	360	1,683	43	719	5,187	18,218	2,726
1940 ...	305	587	2	1,214	380	3,425	12,249	4,892	2,224	1,792	4,034	91	3,429	435	495	7,864	26,067	2,395
1941 ...	122	177	—	4,689	151	4,038	17,970	7,525	6,948	1,676	6,317	56	1,469	6	1,057	9,128	14,355	2,456
TOTAL	16,758	24,270	26,534	363,740	58,250	251,080	300,310	171,950	87,299	36,664	45,249	6,224	49,946	14,396	17,238	179,762	271,250	580,088

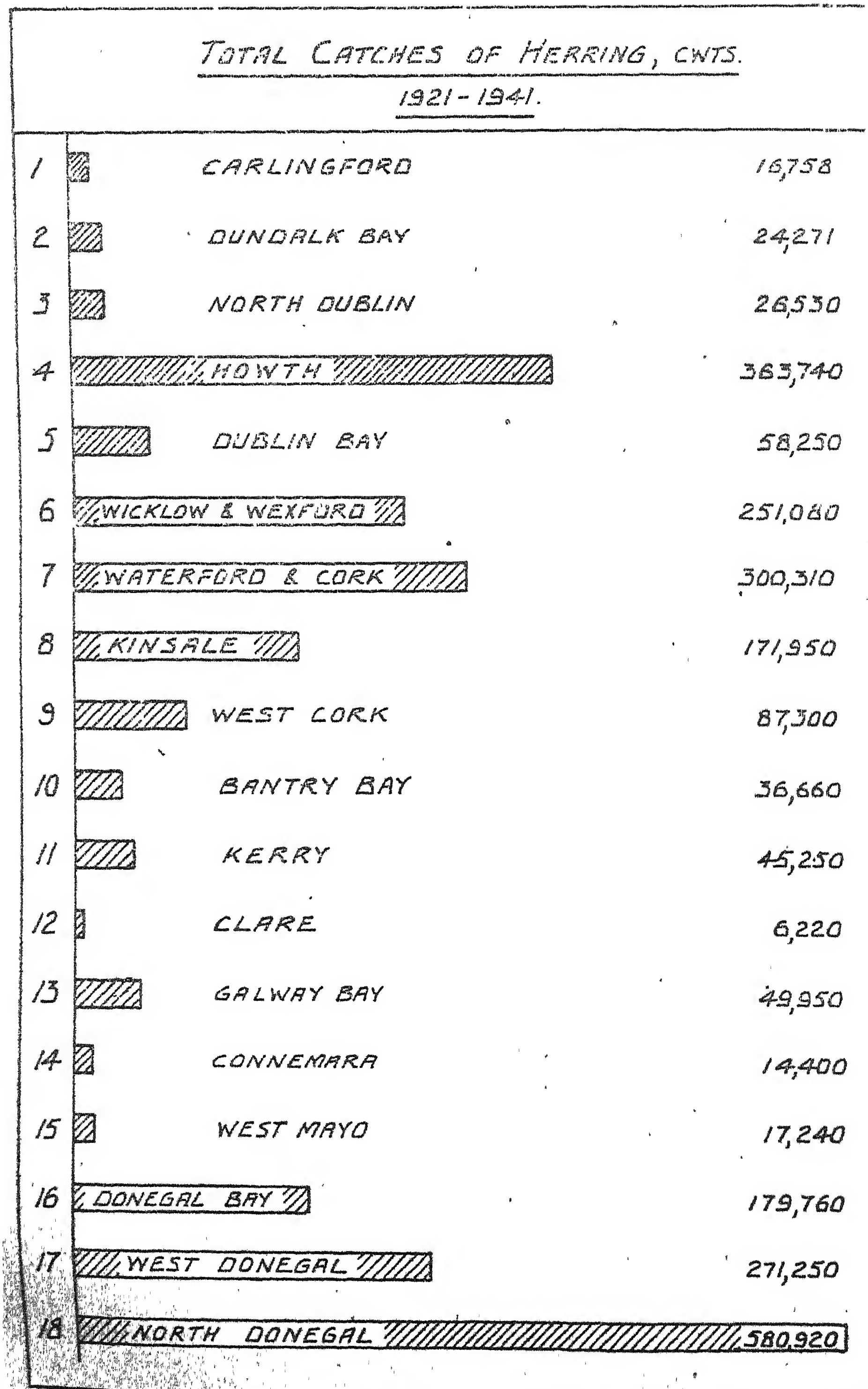

Fig. 2.—Total catches of herrings in each area from 1921 to 1941.

to variations in the stock from year to year, all the fisheries enumerated cannot be relied upon to be productive every year. The places mentioned are those which actually yielded good average returns in the period 1921-41 :–

January : Dublin Bay, Wicklow and Wexford, W. Donegal, N. Donegal, Dunmore E.*, if visiting drifters attend.

February : N. Donegal, Dunmore E.*, if visiting drifters attend.

March : Scarcity everywhere.

April : Kinsale, Dunmore E.*

May : Kinsale, Dunmore E.,* Baltimore, Donegal Bay, N. Donegal

June : Howth, Arklow, Dunmore E.*, Kinsale, Baltimore and neighbouring ports, Donegal Bay, W. and N. Donegal.

July : Howth, Baltimore.

August : Howth.

September : Howth, Bantry Bay, Dingle, Valentia, Galway Bay, Donegal Bay, W. and N. Donegal.

October : Wicklow and Wexford, Kinsale, Baltimore, Bantry Bay, Galway Bay, Donegal Bay, W. Donegal.

November : N. Dublin, Dublin Bay, Wicklow and Wexford, Kinsale, West Cork, W. Donegal, Donegal Bay, if visiting drifters attend.

December : N. Dublin, Dublin Bay, Wicklow and Wexford, Dunmore E.*, Donegal Bay, W. Donegal.

It may be of interest to indicate how the catch of Éire herrings is disposed of. Owing to the seasonal nature of the fishing it is obvious that the landings at one time may exceed the possible home consumption, though at others they may fall short of it. The surplus must be disposed of by export either as fresh fish or preserved by curing or kippering ; the deficiency can be made good by importation from places outside the country where herrings are available at the time, either Northern Ireland, Great Britain or, on occasion, Norway.

The graph (Fig. 4) shows in cwts. the total catch each year during the

*** or alternatively Helvick.**

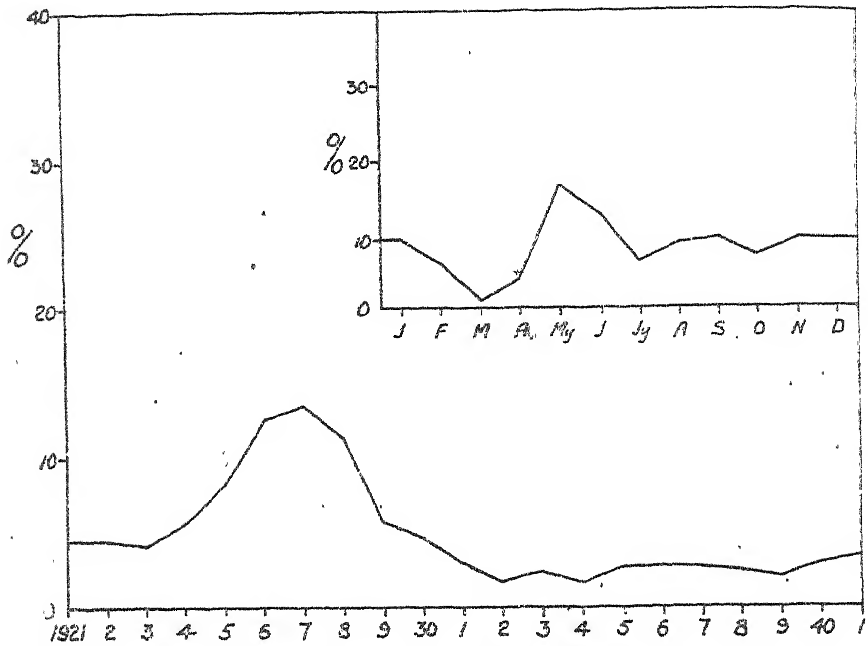

Fig. 3.—Catch herrings each year from 1921 to 1941 shown as percentage of the total catch for the whole period.
Inset—Average catch per cent. each month during the period 1921 to 1941.

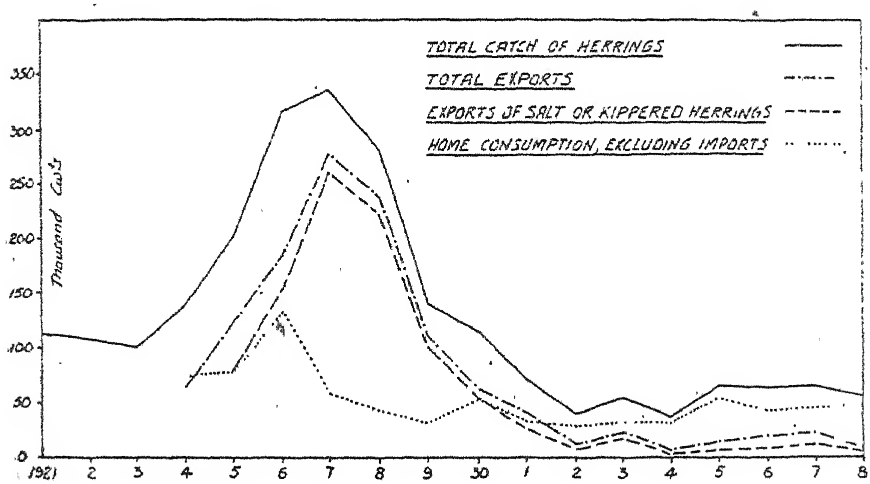

Fig. 4.—Graph showing :—

(*a*) Total catch of herrings in Eire each year from 1921 to 1938.
(*b*) Total exports of herrings each year from 1924 to 1938.
(*c*) Exports of salt or kippered herrings each year from 1924 to 1938.
(*d*) Home consumption of herrings, excluding imports from 1924 to 1938.

years 1921-1938, the quantity exported, both fresh or preserved, and the home consumption, by inference, deducting the exports from the total. The actual figures of exports can be ascertained from the Trade and Shipping Statistics published by the Department of Industry and Commerce, but in taking a general view there is no need to quote them here.

It can be seen from the diagram that when the catches are high, as they were between 1924 and 1930, the bulk is exported in a cured state, but when the takes are small the proportion cured diminishes. It is easy to see why this is so, for small takes will not repay the overhead expenses involved in curing. On the other hand, the market for cured herrings affects the total catch, for if this is weak and if the takes are sufficient to supply the comparatively small demand for fresh herrings there is no inducement to further efforts to increase the catch.

1. Carlingford Lough (*Fig.* 5.)

There is a small autumn and winter herring fishery in the Lough lasting from September to February with a maximum in November. It is carried on by small boats which land their catches at various points in the Lough, Greenore, Carlingford, Omeath, Warrenpoint and Rostrevor, the last two, being Northern Ireland, are not included in the statistics. The statistics of landings are not very detailed, having been obtained mostly for the calendar year and not month by month. The total catch in the 21 years here considered only amounted to 17 thousand cwts., the largest take having been in 1926.

The fish in the beginning of the season (September) are spawning or spent, of medium or small size. None of the fish taken later in the season have been examined.

2. Dundalk Bay (*Fig.* 6).

Landings in Dundalk Bay fall into two classes, a few summer fish taken in June, July and August, which evidently belong to the open Irish Sea fishery, and winter fish taken from October to December, or less frequently from September to December. The fish are landed at Annagassan, Blackrock, Giles' Quay and Clogher Head. The Clogher Head boats are the largest and are capable of fishing in the open Irish sea ; the other places are served by small inshore craft. The total catch for 21 years was only 24 thousand cwts., the peak year, as in Carlingford, being 1926, due to a very successful winter fishing.

No samples from this area have been examined.

3. North Dublin. (*Fig.* 7).

Small boats from Balbriggan, Skerries, Rush and Loughshinny engage in some years in winter fishery for small herrings, an extension northwards of

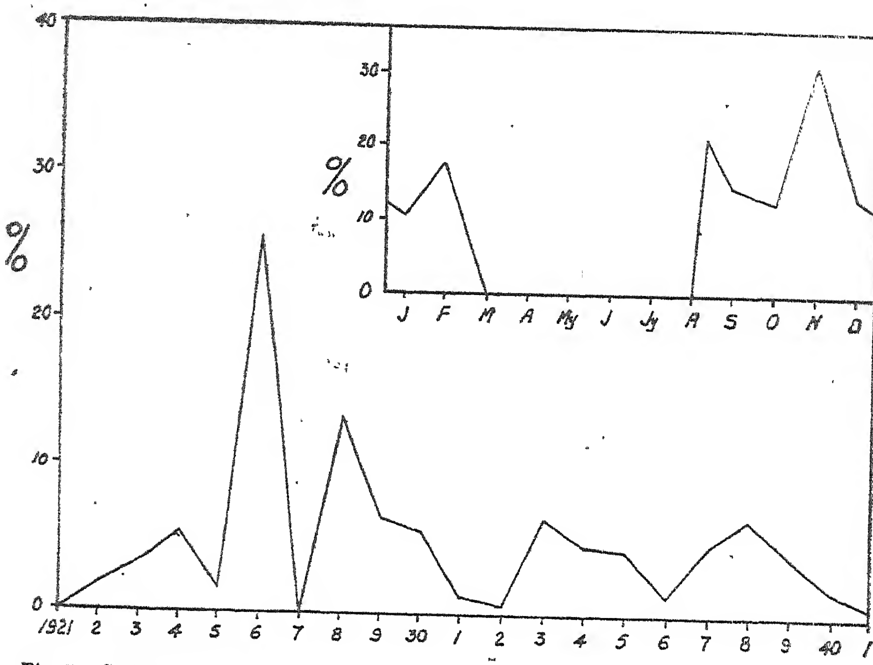

Fig. 5.—Carlingford Lough—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

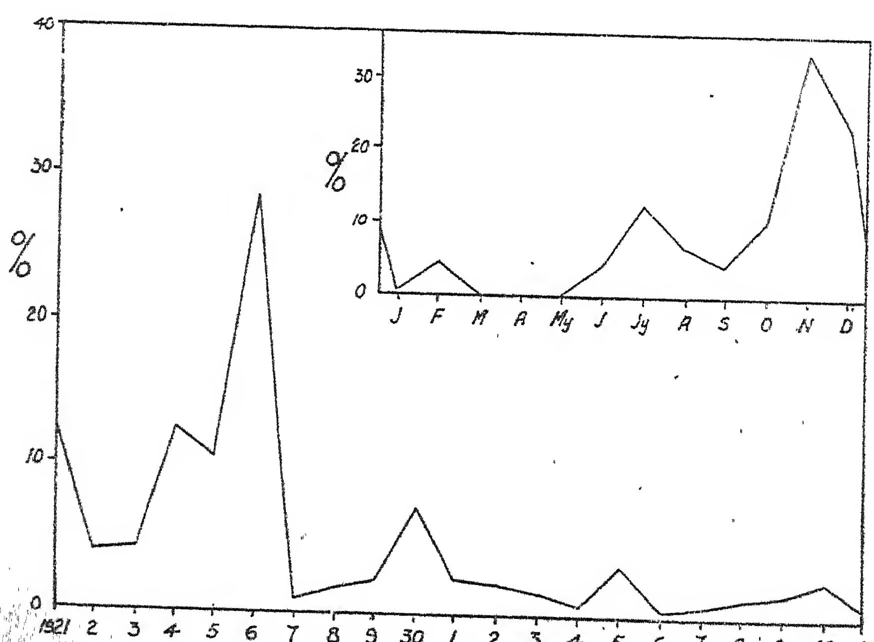

Fig. 6.—Dundalk Bay.—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

the inshore migrating shoals, which spread in winter along the coast from Cahore Point northwards. November, December and January are the usual months for this fishery when it develops. The best fishings occurred in the winters of 1921–22, 1926–27 and 1927–28.

The total catch for 21 years was nearly 27 thousand cwts.

4. Howth. (*Figs.* 8 *and* 9).

The extensive shoals of herrings which frequent the northern part of the Irish Sea in late summer have, over a long period, been fished by visiting boats based on Howth. Most of these boats are from Arklow, but English and Scottish boats also take part. Judging by the statistics of landings this fishery has been exhausted since 1927, but in coming to this conclusion we must take into account the complicated circumstances which determine the amount of landings at a port. These may render uncertain any deductions from landings as to the stock of fish available for capture other than that, when landings are heavy, fish must be abundant. Thus, lack of curing, freshing or berthing facilities may divert boats to other ports, or the start of another fishing may withdraw all but the local boats from a fishing which is still productive.

This applies especially to the herring fishing based on Howth, as the shoals which support it can also be worked from several other ports, some in Northern Ireland and some in the Isle of Man.

The flourishing period of the Howth fishery in the years under consideration was from 1921 to 1927. 1928 showed a marked falling off in the landings and since that time even the low figure of 1928 has never been reached. The fall in the landings entailed a reduction of curing facilities, which must always be prepared beforehand in anticipation of a good catch and cannot be improvised; and, following round the vicious circle, fewer boats took part in the fishing. Other circumstances, such as a fuel oil shortage in recent years, have combined to divert the fishermen to North of Ireland and Manx ports.

In the seven years from 1921 to 1927 the average annual landing at Howth was 42 thousand cwts., the peak year being 1926, but from 1928 to 1941 this average dropped to five thousand cwts. The total catch from 1921 to 1941 amounted to nearly 364 thousand cwts.

The main period of the Howth fishing comprises the months of June, July, August and September, July and August being the most productive. From October to February a few small herrings are taken inshore by small local boats, but from March to May the fishing is blank.

The composition of the shoals both as regards age and size shows great variation from year to year and also from place to place. The average age

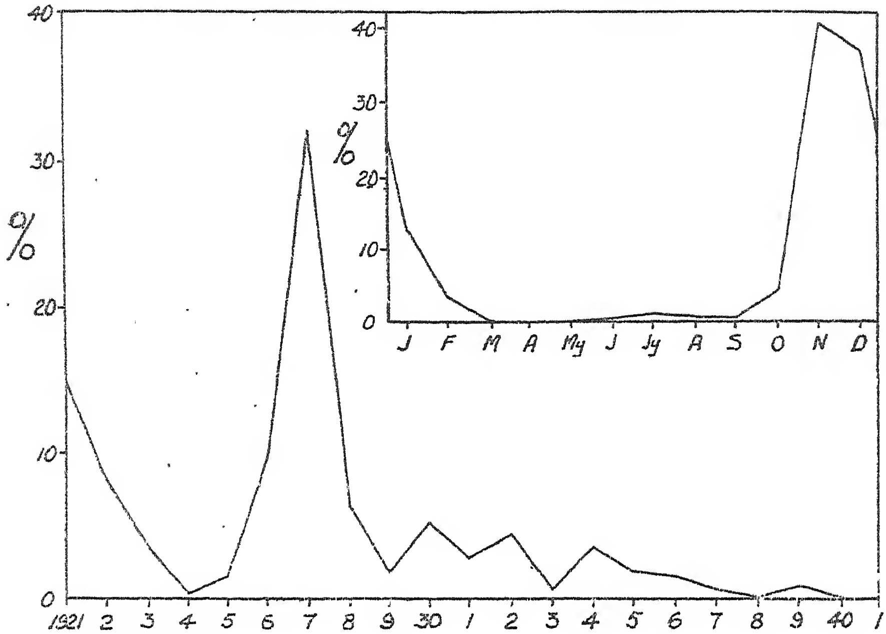

Fig. 7.—North Dublin—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

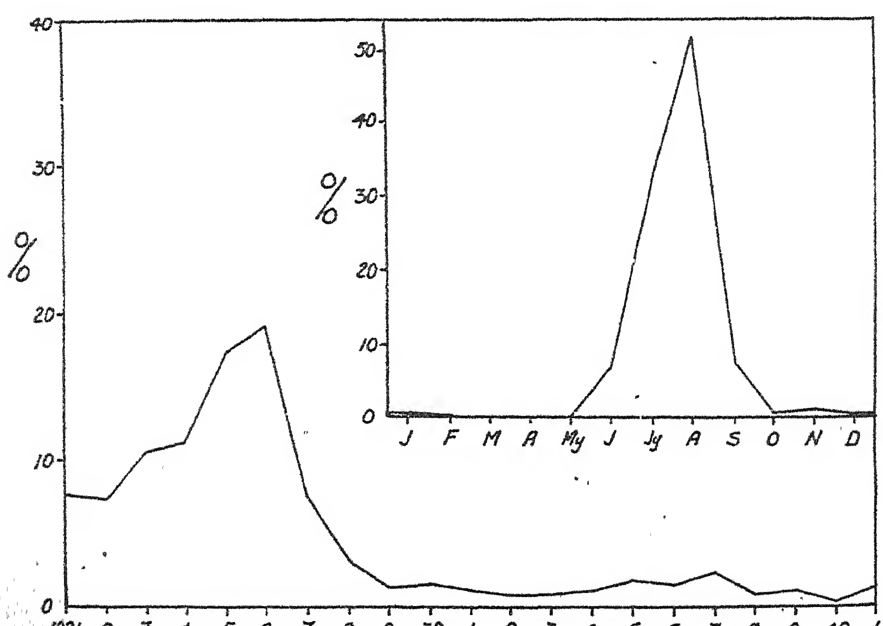

Fig. 8.—Howth—Landings of herrings each year shown as percentage of the total landings at Howth from 1921 to 1941.
Inset—Average landings per cent. each month during the period 1921 to 1941.

composition of 33 samples which have been determined between 1921 and 1939 was :

Age :	1	2	3	4	5	6	7	8	9	10	11	12 years
	.3	31.1	23.5	15.5	11.9	8.7	4.6	2.6	1.2	.4	.1	.05 per cent.

Median 3.29 years.

As regards the size the same samples gave :—

Length ..	20	21	22	23	24	25	26	27	28	29	30	cm.
	.3	3.3	8.0	13.1	14.4	15.4	14.1	12.8	11.2	6.7	.3	per cent.

Fish below 22 cm. or above 29cm. are scarce at all times but between these limits the sizes vary from year to year, large fish having been more abundant in the years 1924, 1925 and 1936.

The maturity also varies from year to year according as the younger or older year classes prevail, but in general there is an advance in maturity as the season advances, the average maturity of the samples from June to September being :—

	*I	II	III	IV	V	VI	VII	VII-II	
June	10.5	62.5	12.7	3	—	—	—	1.5	per cent.
July	12.6	23.3	24.7	18.4	19.5	1.2	—	—	,,
Aug.	6.5	12.7	11.1	25.2	45.5	.4	—	—	,,
Sept.	2.0	11.8	14.8	27.2	41.8	.2	—	2.0	,,

As the fish reach the spawning stage they disappear from the fishing grounds or at any rate are no longer subject to capture.

Usually a moderate proportion, but in some years quite considerable numbers of fish are in an early stage of development of milt and roe in September and it seems unlikely that they would spawn that autumn, but whether they are actually autumn spawning fish, or spring spawners which are occupying the same area, is uncertain.

The condition, that is the weight for size, is good throughout the fishing season and does not show much variation. Taking the very highest weight that a fish of any given size can reach as 100 the average condition is between 80 and 90, rarely higher or lower than those limits.

Though the Irish Sea does not afford such rich feeding as the west or south coasts of Ireland yet there does not seem to be any noticeable scarcity

*In this paper the Roman numerals represent successive stages in the development of the gonads or milt and roe, I indicating very small and undeveloped, II to V increasing in size, VI spawning, VII spent, VII-II recovering from spawning. Stage I is not repeated in the cycle.

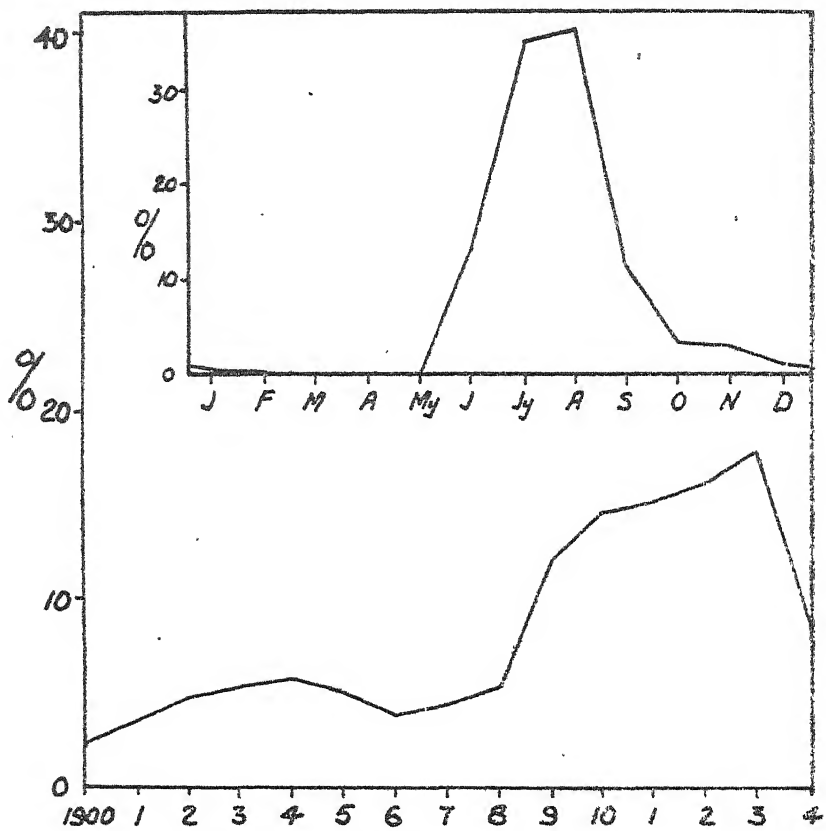

Fig. 9.—Howth—Landings of herrings each year from 1900 to 1914 shown as percentage of the total landings from 1921 to 1941.
Inset—Average landings per cent. each month during the period 1900 to 1914.

of the organisms on which herrings feed, though their development occurs later than in the Atlantic waters. The herrings when they appear on the fishing grounds are already in fair condition and only exceptionally have food in their stomachs when caught, though occasionally samples may be taken which have been feeding on copepods, euphausians (small shrimps) or sand eels.

Fishing takes place from 10 to 30 miles from Howth in the area between Howth and the Isle of Man, the most frequented grounds being from 12 to 16 miles N.E. to E.N.E. of Howth.

In late autumn small quantities of spent herrings are sometimes taken in moored nets in Balscadden Bay, close to Howth Harbour (scadán in Irish means herring). These are no doubt, stragglers from the shoals fished earlier in the year.

As regards rate of growth the following are the sizes of fish with successive numbers of winter rings on their scales, from samples taken in July and August. As these fish are preparing to spawn and rarely have food in their stomachs it is unlikely that much growth could take place before the next year ring is formed in the following winter, and they may fairly be compared with fish with an additional year ring taken at the beginning of the year in other localities :—

Year rings	2	3	4	5	6	
Length	24.2	25.4	27.0	28.0	29.3	cm.

This growth is less than that of herrings from every other Irish locality which have been examined and agrees fairly closely with the published figures of growth rate of herrings from the offshore grounds of the Isle of Man.*

For comparison with the annual catches from 1921 to 1941 a graph (Fig. 9), drawn to the same scale as Fig. 8, *i.e.*, showing percentages of the total catch from 1921 to 1941, is given for the years 1900 to 1914.

5. Dublin Bay—Ringsend and Dunlaoghaire. (*Fig.* 10).

Considering the small size of this area there is at times in it quite a profitable winter inshore fishery for small herrings from October, or more usually November to February; or rather there used to be, for the January and February catches since 1935 have been negligible. The quantities taken show considerable variation from year to year, 1934 and 1935 having been the best years. The shoals, like those taken on the coast of N. Dublin are an extension of those occurring in winter on the Wicklow and East Wexford coasts, from which they are indistinguishable in size, age and condition.

*W. C. Smith. The Manx Herring Shoals. *Proc. and Trans. Liverpool Biol. Soc.*, Vol. LI., 1938.

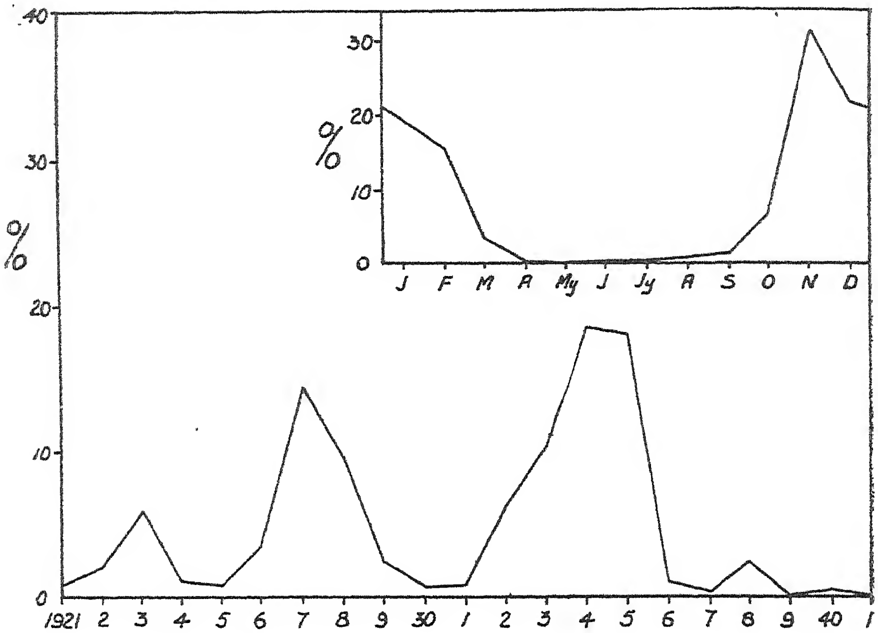

Fig. 10.—Dublin Bay—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921-1941.

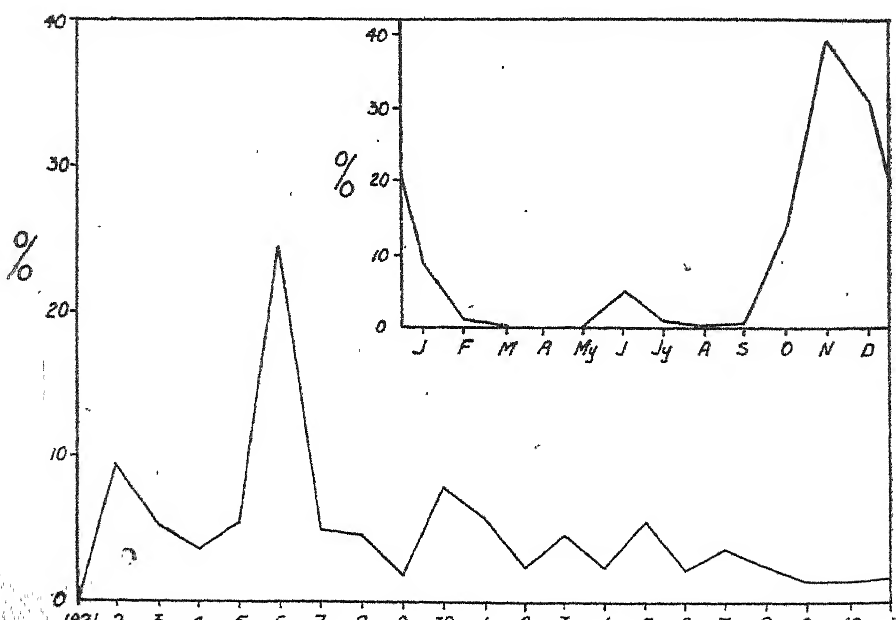

Fig. 11.—Wicklow and E. Wexford.—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

These fish would seem to be the original Dublin Bay herrings, well known long before the Howth fishery flourished. At times they attract attention by making their way into the outskirts of the city, up the River Liffey. The total catch for 1921 to 1941 amounted to 58 thousand cwts. The peak seasons were the winters of 1933–34 and 1934–35, the next best being the winter of 1926-27.

6. Wicklow and E. Wexford. (*Fig.* 11).

There are a large number of small towns and fishing villages along the east coasts of Wicklow and Wexford for which the annual winter herring fishing from October to January is an important event. Herrings at this time are landed at Bray, Greystones, Wicklow, Arklow, Kilmichael, Courtown, Morris Castle, Curracloe, Ballygeary, Rosslare and Cahore.

The fish are small, though probably not on an average so small as those landed would indicate, for they are mostly taken with nets of very small mesh, These nets, being valuable to the owners, are carefully tended from year to year, the mesh growing smaller with every successive cutching or tarring. They are fished usually within half a mile of the shore with short trains, which lessen the wear and tear, and nets of 10 or 12 years old may be found in use.

The season starts in the south, usually at Rosslare, in October and reaches a maximum in November and December. Previous to 1936 it used sometimes to extend into January.

The fish, as regards maturity, fall into two classes—those ripening the gonads preparatory to spawning in the current winter or early spring (Stages III-V) and those with undeveloped milt and roe—the latter amounting to about 30 per cent., sometimes more and sometimes less, and consisting both of spent fish recovering from spawning and of young fish which apparently have not yet spawned. The maturing fish have their milt and roe in stages III, IV and V, the males having the more developed gonads for their size, approximately 70% heavier than in the females. These maturing fish are in fair condition but not as good as the Howth summer herrings, their weights being represented by 75 to 80 as compared with the Howth fish which have reached 80 to 90 per cent. of the highest quality; the fat on their gut is only slight or moderate. Both the spent and the undeveloped fish are thin, their weight being represented by 60 to 70, the recovering spent fish being the drier while the undeveloped fish show slight traces of fat on the intestines.

The spent fish are probably stragglers from the shoals that had spawned in autumn in the Irish Sea. The maturing fish we may conjecture, are destined to join the spring spawning shoals on the south coast. The origin and destination of the undeveloped young fish are uncertain. The average age of these

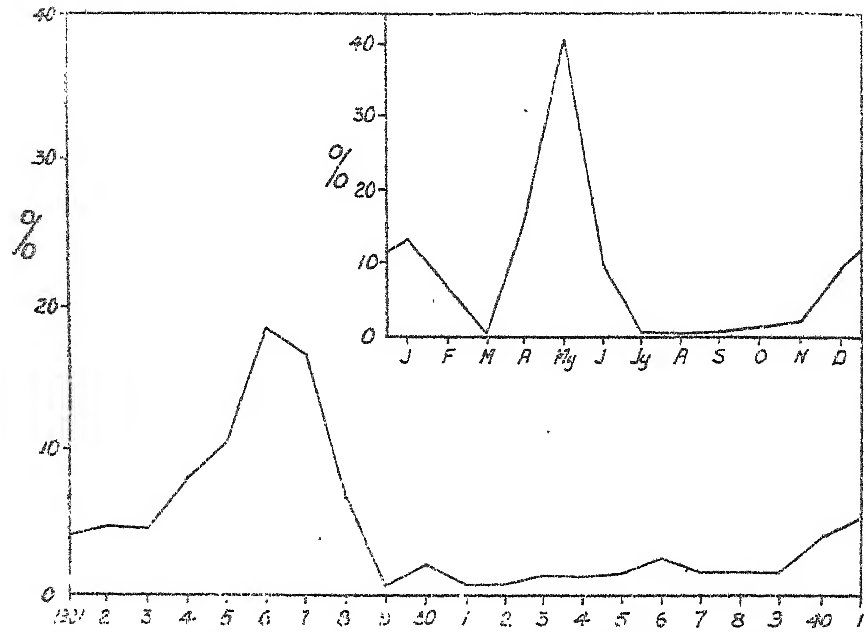

Fig. 12.—Waterford and E. Cork.—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

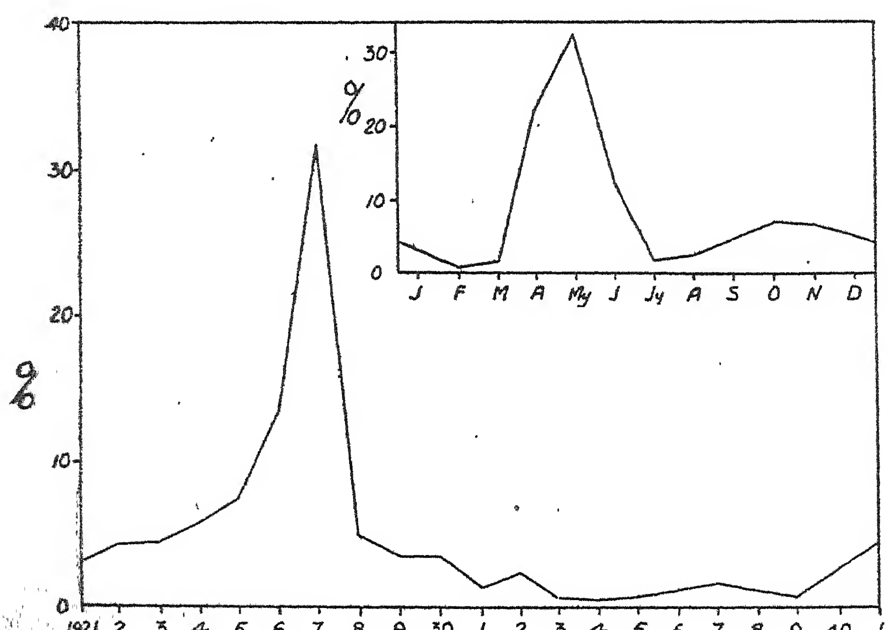

Fig. 13.—Kinsale—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

inshore fish, is shown by the winter rings on the scales is (not counting the ring in process of formation).

Year rings	1	2	3	4	5	6	
Number	6	71	15	5	2	1	per cent.

This means that a fish with two rings if spawned in spring would be nearly three years old or, if spawned in autumn, (too late to form a ring in the following winter) slightly over three years.

The object of these fish in thus coming close inshore is not clear. There is no great abundance of food there and they rarely have food in their stomachs.

The best years in the period under review were the winters of 1926–27 with 61 thousand cwts. and 1922–23 and 1930–31 with 23 thousand cwts. each.

There is also a small summer fishery further to seaward, carried on by Arklow boats in June and July, apparently a southward extension of the summer fishery based on Howth. The fish are similar to those taken off Howth in the same months.

There is a persistent belief amongst the Arklow fishermen that these offshore shoals are on migration from the south coast to the grounds near the Isle of Man; but except for the fact, which seem well attested, that the fishing starts and ends sooner than that based on Howth, this theory has not much to support it.

The total landings of the period 1921-41 amounted to 251 thousand cwts.

7. Waterford and East Cork. (*Fig.* 12).

The mainstay of this fishery, which may be taken as extending from Carnsore Point to the Old Head of Kinsale, is, or rather used to be, the fleet of steam and motor drifters based on Dunmore E. which worked the south coast shoals of fattening fish in April, May and June at distances of from 10 to 35 miles off shore, mainly in a south westerly direction from port. These drifters were usually boats from Yarmouth or Lowestoft which resorted to Dunmore after the conclusion of the East Anglian herring fishery. This fleet also worked the same grounds in December and January for full, spawning and spent fish, till the poor quality of the spent fish made the demand slacken. As, since the introduction of steam drifters, these offshore shoals can also be fished from Milford Haven, a number of the boats fishing these grounds would run their large catches to that port and only resort to Dunmore or to Helvick when the fishing was light, or when prices at Dunmore E. proved more attractive, consequently inferences as to the size of the shoals

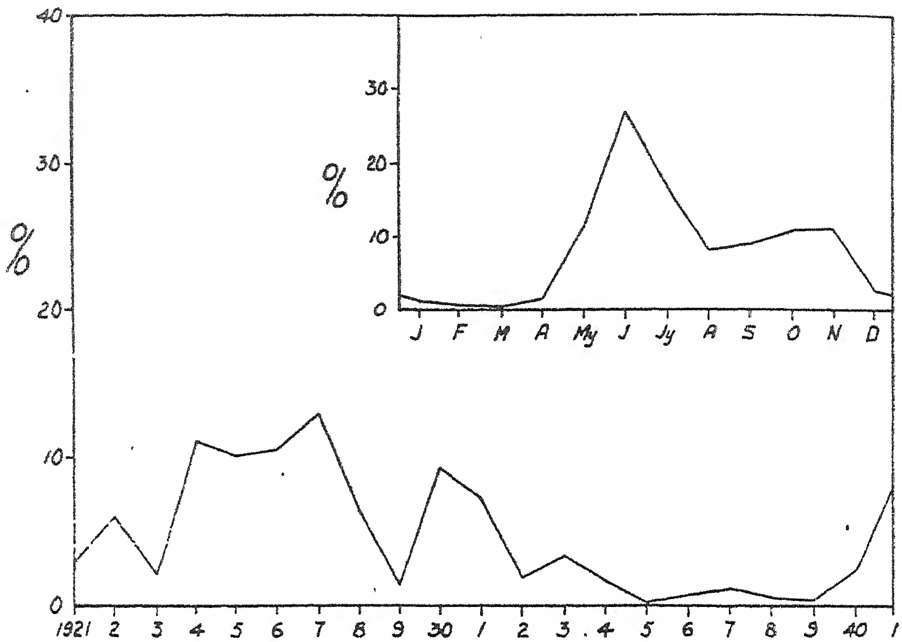

Fig. 14.—West Cork—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

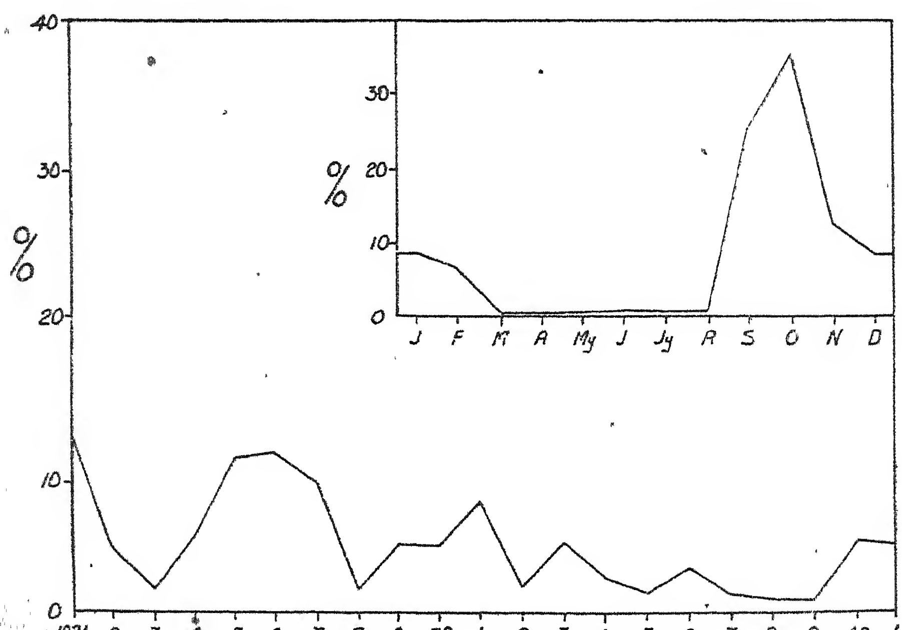

Fig. 15.—BantryBay—Catch of herrings each year shown as percentage of the total catch landed in area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

from the landings at Dunmore must not be too strongly stressed. The fish taken in April are at first in poor condition after spawning but, owing to the rich feeding on the south coast, they rapidly improve, and by the middle or end of May almost all are matties in first class condition.

The fish vary very much in size from season to season but on the whole the average size is markedly higher than in the Howth fishery, the average length of all samples examined being :—

Length	21	22	23	24	25	26	27	28	29	30	cm.
Number	.3	1.5	4.4	8.4	11.8	14.2	16.1	17.3	15.7	7.7	2.5 per cent.

The ages of the fish in the same samples as shown by the year rings are :—

Age	2	3	4	5	6	7	8	9	10	years.
Number	11.2	26.2	19.9	17.5	11.3	6.5	3.9	1.9	.8	per cent.

This gives an average age of 4.13 years as compared with 3.33 in the Howth shoals.

The average maturity of the fish throughout the season is :—

	I	II	III	IV	V	VI	VII	VII-II	
January	—	1	—	2	41	40	11	5	per cent.
May	12	70	—	—	—	—	1	17	,,
June	37	56	1	1	—	—	—	5	,,

The increase in stage I in June seems to be due to shoals of maiden fish coming on the grounds.

As regards food, fish taken in April, May and June have usually food in their stomachs, sometimes in large quantities. The main food is the copepod Calanus but the larval crustacea and fish are also eaten at this time; in April Euphausians, small shrimp-like crustacea, sometimes occur in large numbers. From November to February the stomachs are empty.

As regards rate of growth, this is slightly greater than in Irish Sea fish. The average size of the successive year groups at the close of the last year's growth, as shown by the actual size of the fish captured, is :—

Age	2	3	4	5	6	7	years
Length	22.4	24.7	26.7	28.0	28.7	29.5	cm.

*As the 2 year and possibly the 3 and 4 year fish are represented in the catches by the more rapidly growing individuals the sizes given are larger than if they had been taken from all the fish of those ages.

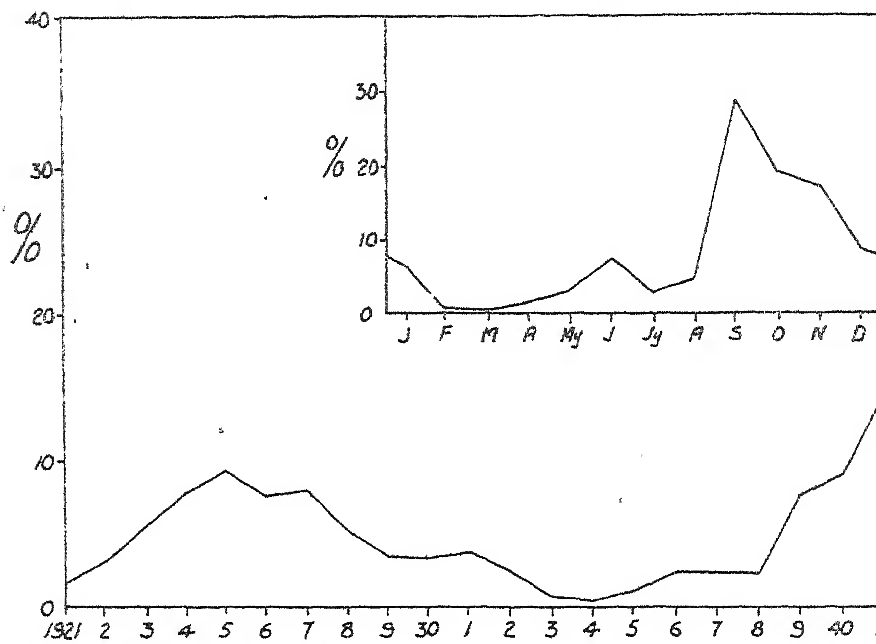

Fig. 16.—Co. Kerry—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

The highest catches were made in the years 1926 and 1927, the total take in the period under review being nearly 300 thousand cwts. The very low takes since 1929 were, as indicated above, mainly due to a diminished intensity of fishing.

8. Kinsale. (*Fig.* 13).

Though the safe and convenient harbour of Kinsale has been for a long period mainly a mackerel fishing centre, it has also been the headquarters of visiting fishing boats which are working the offshore herring shoals on the western part of the south coast of Ireland. The numbers of these visitors vary very much from year to year and the size of the total catch varies to a great extent accordingly. The peak period of the fishery since 1921 was the year 1927, the two previous years having also been good ones, but since that date there has been a rapid decline.

The main fishing season is in April, May and June, the fish taken at the beginning of this season being thin recovering spents, which give place about the middle or end of May to fat, well fed fish with small gonads, the abruptness of the change suggesting the arrival of separate shoals. There is also a winter fishery from September to January, either with seines in the harbour or with drift nets outside. These winter herrings are a mixture of very small fish and spent fish of larger size, probably autumn spawners, the fish taken in summer being spring spawners.

The summer caught fish vary in size from year to year and also in age, and on an average are both larger and older than the Dunmore fish. The average length of eleven samples examined was :—

Length	22	23	24	25	26	27	28	29	30	31	32	cm.
Number	.2	.9	2.4	5.7	9.0	15.4	19.2	21.8	17.5	7.2	.7	per cent.

The age of these samples as shown by the number of year rings was :—

2	3	4	5	6	7	8	9	10	11	12	year rings.
3.3	19.0	22.8	20.1	16.6	8.3	5.0	2.9	1.6	.2	.1	per cent.

These figures give an average age of 4.9 years, assuming the spawning period to have been shortly before the fishing commences, as compared with an average age of 4.1 years in the Dunmore fish.

This greater age is not sufficient to account for the larger size of the fish, for the size at the formation of the last winter ring of these fish is :—

Age	3	4	5	6	7	years
Length	25.8	27.5	29.1	29.8	30.5	cm.

or about 1 cm. larger than Dunmore fish of the same age.

The feeding period is short. Up to the end of April the stomachs are empty but during May and most of June all fish have more or less food, though not in very large quantities. At the end of June feeding falls off and for the rest of the year the stomachs are again empty or practically empty.

Kinsale comes seventh in importance in the fishing areas here recognised with a total catch of 172 thousand cwts. for 1921 to 1941.

9. West Cork. (*Fig.* 14).

There are a number of small ports and havens on the south coast, including Courtmacsherry, Union Hall, Castletownshend, Baltimore, Schull, Kilcrohane and Crookhaven. lying to the west of Kinsale at which herrings are landed, mainly by local boats, though visiting motor boats may from time to time make landings at Union Hall, Baltimore and Schull. The fishing starts rather later than at Kinsale and reaches its peak in June. These summer fish, taken in May, June, July and August from 10 to 12 miles off shore, are full and fat. Later in the season from August to November and early in December, herrings are taken, usually in moored nets, in Barley Cove to the eastward of Mizen Head where, apparently, they come in to spawn. From October to December these fish are mostly spent.

The total landings in this area for 1921-1941 amounted to 87 thousand cwts.

10. Bantry Bay. (*Fig.* 15).

There is a considerable local herring fishing carried on in Bantry Bay, commencing in September for full fat fish, with increasing numbers, from October onwards, of spawning and spent fish. This fishing lasts well into February and is pursued both by local boats with seine and moored nets and, at times, by visiting drifters. A good deal of the fish when it was plentiful was sent to Baltimore for curing.

The total catch from 1921 to 1941 was 36 thousand cwts.

11. Coast of Kerry. (*Fig.* 16).

Off the coast of Kerry herrings are taken mainly from September to January, full fat fish at first but, after October, mainly spent. The fishing is pursued by local motor boats and yawls, mainly from Dingle and Valentia, from near shore to 10 miles off. As the main fishery in this area is for mackeral in the spring and summer, no particular attention is paid to herrings except in autumn, and the fishing is often interrupted for long periods in winter on account of bad weather. Occasionally, however, landings are made in June, especially at Valentia.

The fishing showed a marked falling off from 1925 to a minimum in 1934, but since then there has been, at first a gradual, and then a rapid revival to

a maximum in 1941, the increased catches since 1939 being most probably due to increased demand and better prices.

The total catch for the period 1921-1941 amounted to over 45 thousand cwts.

12. Co. CLARE. (*Fig.* 17).

Owing to the absence of harbours there is practically no herring fishing on the coast of Clare. A few fish are taken every autumn inshore at Seafield on the Atlantic coast, from September onwards to the end of the year, mainly in October. These appear to be autumn spawners, probably part of the shoals which are fished in Galway Bay at the same period. In 1922 and 1923 small shoals were present in the Shannon estuary but they have not been seen, or at any rate reported, since that time.

The total catch in this area for 1921 to 1941 only amounted to 6,220 cwts.

13. GALWAY BAY. (*Fig* 18.)

Galway Bay has always had a reputation for herrings far exceeding its present importance compared with many other areas. Owing to the absence of visiting boats the large variations in the landings, due to causes other than the variations in the stock, are absent, the demand and the fishing power remaining relatively constant. The catch, though never very large, is rarely very small and, in fact, 1932 was the only year in which it could be said that fishing was a total failure.

The area fished extends from the Aran Islands to the head of Galway Bay and boats of all classes, from large motor boats downwards, take part in their respective neighbourhoods.

The fishing starts at the beginning of September for filling fish in good condition. In October spent fish in increasing numbers appear in the catches and by November practically all are spent except for an occasional admixture of small maiden fish. In January and February small numbers of full or spawning fish appear in the bay, possibly stragglers from spring spawning shoals outside.

The period under review commenced with the comparatively large take of 6,483 cwts, in 1921, which has not since been exceeded. This was the end of three years of very good fishing, the catch in 1920 exceeding 8,400 cwts. and that in 1919 13,000 cwts.

The few samples which were examined for age determination indicated a growth rate slightly greater than that of Kinsale but the figures were not sufficiently certain for quotation as there had evidently been selection of the more rapidly growing young fish by the mesh of the nets.

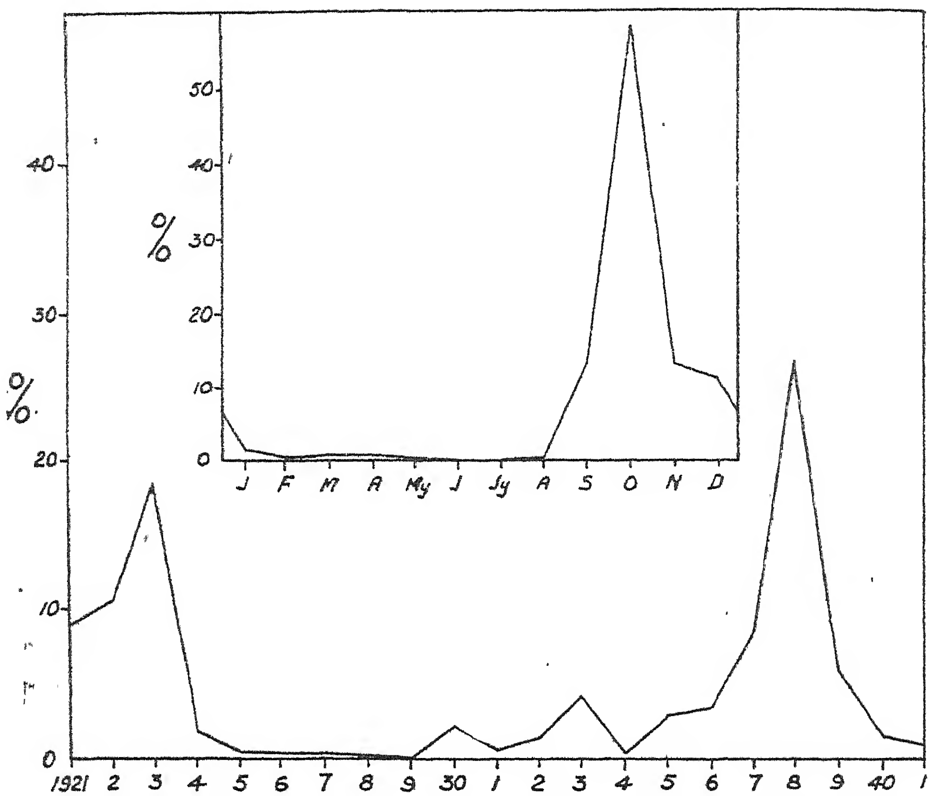

Fig. 17—Co. Clare—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

The total catch of 1921 to 1941 amounted to almost 50 thousand cwts.

14. CONNEMARA. (*Fig.* 19)

Small shoals of filling or full herrings, nearly ready to spawn, are met with close inshore from August to December when they make their way into the bays and inlets of the coast. When spent towards the end of the period they become scarce, having apparently migrated out to sea to feed. They are mostly fish of good size, 27 to 31 cm. long. The numbers taken are insignificant, being mainly the produce of fishing by small boats with a few old nets, the total catch from 1921 to 1941 only just exceeding 14,000 cwts. The most productive years were from 1921 to 1927 and since then the catches have been negligible, the activities of the fishermen farmers being mainly directed towards the autumn mackerel.

15. WEST COAST OF MAYO. (*Fig.* 20).

As in Connemara, the fishing is mainly for autumn spawning coastal herrings, taken, however, over a shorter period, from August to November, with a well marked maximum in September. The catch from December to July is negligible. The total quantities landed are very small, very little more than in the Connemara district, almost all being used for local consumption, either cured or fresh. Most of the fish are taken in the neighbourhood of Clare Island and Achill Island. The total landings from 1921 to 1941 were 17,240 cwt. The most productive years did not correspond with those in Connemara.

16. DONEGAL BAY. (*Fig.* 21).

The fishing in this area as far as large takes are concerned, depends on the visits of steam and motor drifters, which in some years are attracted by the facilities available in Killybegs Harbour, the only centre which offers them satisfactory accommodation, though Teelin is sometimes used as an alternative. These boats fish along the North Mayo Coast and off Donegal Bay and Rathlin O'Birne for spring spawning herrings which in May and June are coming into condition after spawning. This summer fishing is also pursued by smaller local boats but their success depends upon the position of the shoals, which are often located beyond their range of action. The visiting boats also take a small part in the September fishing for autumn spawning fish but this is mainly pursued by local craft, fishing short trains of drift nets or ring nets much closer inshore. After spawning these fish are sometimes taken in fixed nets along the shore in Bruckless and Fintra Bays. A few attempts by steam drifters since 1921 to develop the early fishing for spring spawners before they have spawned, which at one time was a feature of the North Donegal fishery, have met with no success.

The peak period of the fishing in this area was the summer fishing in 1928 and 1929, when an abundance of fish off the coast attracted large numbers of steam drifters, mainly Scottish, to Killybegs. The autumn spawning fish

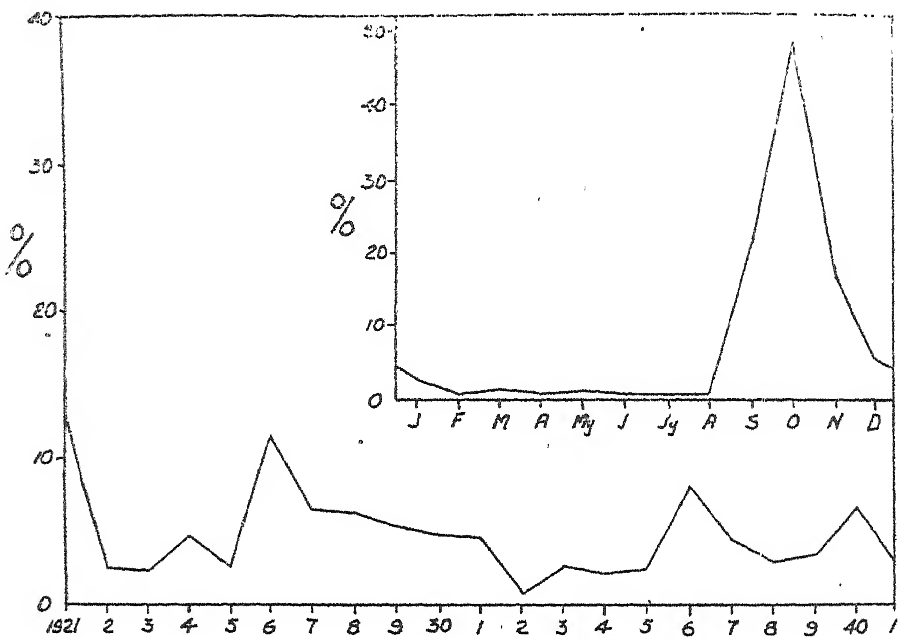

Fig. 18.—Galway Bay—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

in 1928 also yielded a good return, probably on account of increased fishing power owing to the operations of these drifters. The relative catches of spring and autumn spawning fish for 1927 to 1932 are indicated on the graph showing the total annual catches.

The total catch from 1921 to 1941 amounted to 179 thousand cwts. as compared with 17 thousand from the W. Mayo coast. The fish agree in size and age with those of the North coast of Donegal, of which particulars are given later.

17. West Donegal. (*Fig.* 22).

The broken nature of the west coast of Donegal with its numerous inlets and sheltering islands gives facilities to the local fishermen to maintain more seaworthy and larger boats with which to work in the open Atlantic than those which are used by the men on the West Galway and Mayo coasts. Consequently we find that the herring fishing can be pursued further out in the open sea and depends less on the presence of visiting boats. Further it is not overshadowed by the mackerel fishery, as is the case further south.

The herring fishing falls into three distinct periods as in Donegal Bay. From December to January there is a fishery for spring spawning fish coming in from the open sea preparatory to spawning. These fish are mainly taken in the open Atlantic from the outer line of headlands inwards, a further extension seawards being beyond the capacity of the boats used. Large meshed nets are used, the herrings for the most part being large, full and fat. In February, March and April the fish are spawning and out of condition and are not pursued, but in May and June fishing is resumed with drift nets a few miles off the coast, with a tendency to work northwards towards Tory Island, and occasionally with seines closer inshore. Two blank months follow, July and August, the spring spawners having left the coast but in September the autumn spawners arrive and are fished for from one to three miles from the coast, usually with seines for surrounding the shoals at sea, a method of fishing which was learned from the Campbelltown fishermen. These fish are full in September but have mostly spawned in October.

As regards size and age the herrings of the west coast of Donegal, both spring and autumn spawners, correspond fairly closely with those of Donegal Bay and the north coast, and the combined particulars of the fish from all three areas are given in the section dealing with the north coast.

The catches on the west coast of Donegal from 1921 to 1941 were only exceeded by those from North Donegal, Howth and the Waterford and Cork coasts. They amounted to 271 thousand cwts.

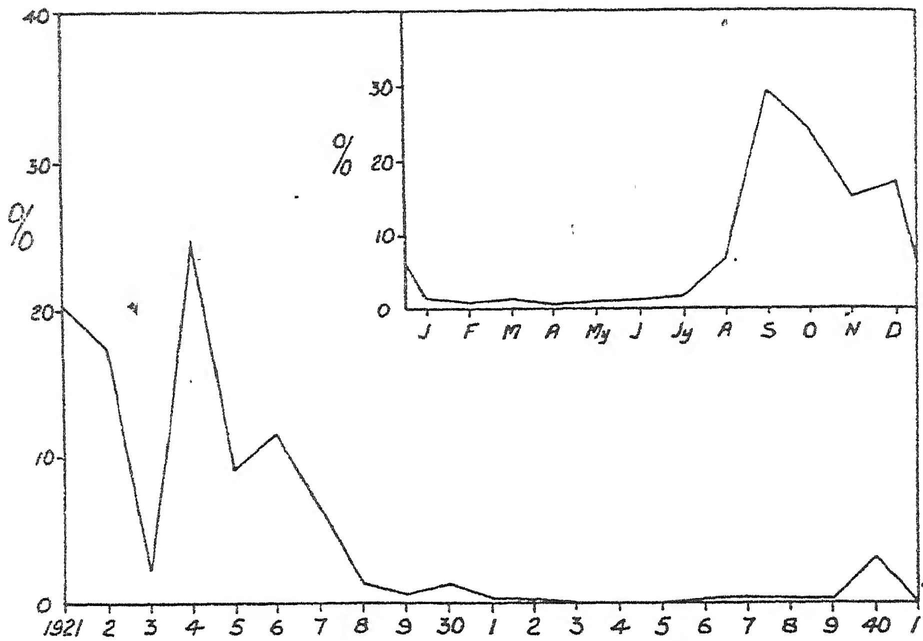

Fig. 19.—Connemara—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

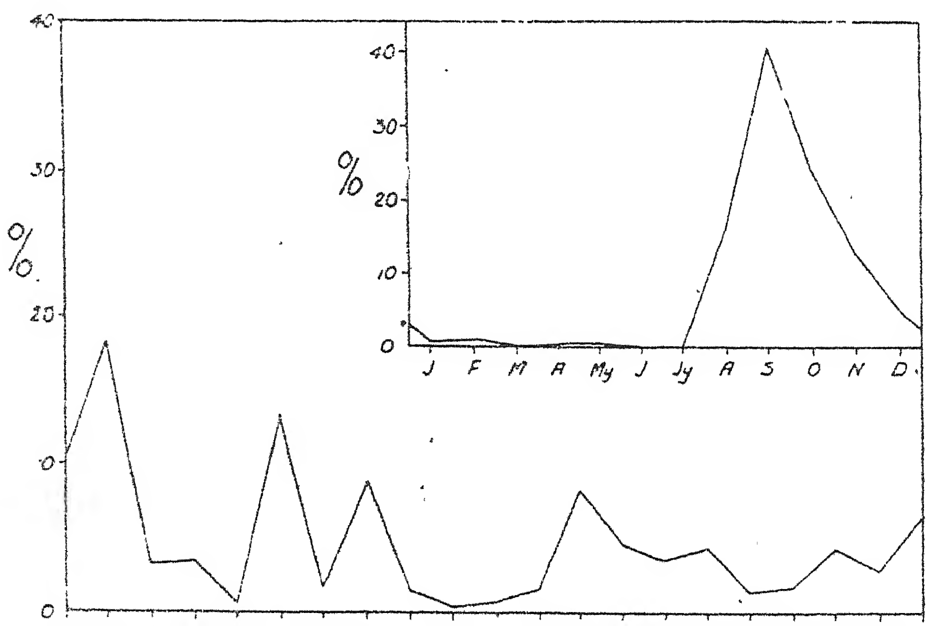

Fig. 20.—West Coast of Mayo—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.r
Inset—Average catch per cent. each month during the period 1921 to 1941.

18. NORTH DONEGAL COAST. (*Figs.* 23 and 25.)

The herring fishing off the north coast of Donegal, except for the relatively small fishery for autumn spawners in September, is of comparatively recent origin, for since it is carried on outside the reach of small boats and practically even of large sailing boats unless equipped with auxiliary power, its possibilities could not be realised until the arrival of steam drifters on that coast. Even then the presence of herrings in January and February was not recognised by the first steam drifters to make a trial of the fishery, for it was assumed that, as on the west coast of Donegal, the fish would arrive in November or December. Some abortive trials were made between 1902 and 1906 but the boats left before the arrival of the main shoals and it was not till 1908 that the spring fishery assumed its proper importance and attracted large numbers of visiting boats, mainly steam drifters. This initiated the most prosperous period of Irish herring fishing, when over 300 steam drifters were based on Buncrana, and the catch reached in 1911 a total for the north coast of 312 thousand cwts. The fishing was still flourishing in 1914, with a total of 133 thousand cwts. when war conditions intervened, and it did not revive till 1925. The peak of the revival occurred in 1927, with 122 thousand cwts. and was followed by a steady decline to a minimum in 1932. Since then there have been ups and downs at a low level, clearly due to the scarcity of fish.

Investigations into the age of the fish, based on an examination of the scales, have shown that the second revival of 1925-1929 was due to the great abundance of fish spawned in 1920, 1924 and 1925. Subsequent spawnings have given very poor returns.

The early fishing of 1900-1914 illustrates very well how the statistics of landings may be an indication of the number of boats fishing, even more than of the abundance of fish, though as remarked earlier, if the fish are scarce the boats will leave for another locality or cease fishing.

An additional graph (*Fig.* 24) shows the total landings on the N. Donegal coast from 1900 to 1941, and, to illustrate the relation between the annual catch and the presence of steam drifters, it also shows the landings at Buncrana from 1902 to 1915 and the number of steam drifters fishing from that port during the same period. These are the only years for which such figures are available. The numbers of steam drifters shown are the sum of those taking part in the spring and summer fisheries. Buncrana was the port principally used by steam drifters in those years and the bulk of the landings there were made by them, though considerable numbers were also landed at Downings Bay.

The monthly landings during the period 1901-1914 are indicated in Fig. 25. It may be seen by comparing this graph with that for 1921-1942 in Fig. 23 that although the three fishing periods, January-February, May-June and

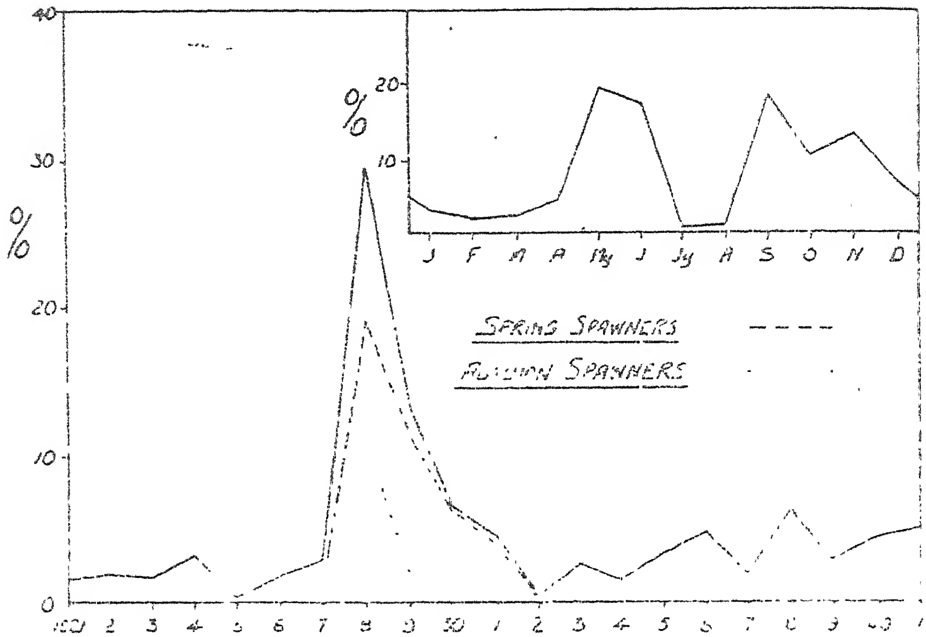

Fig. 21.—Donegal Bay—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

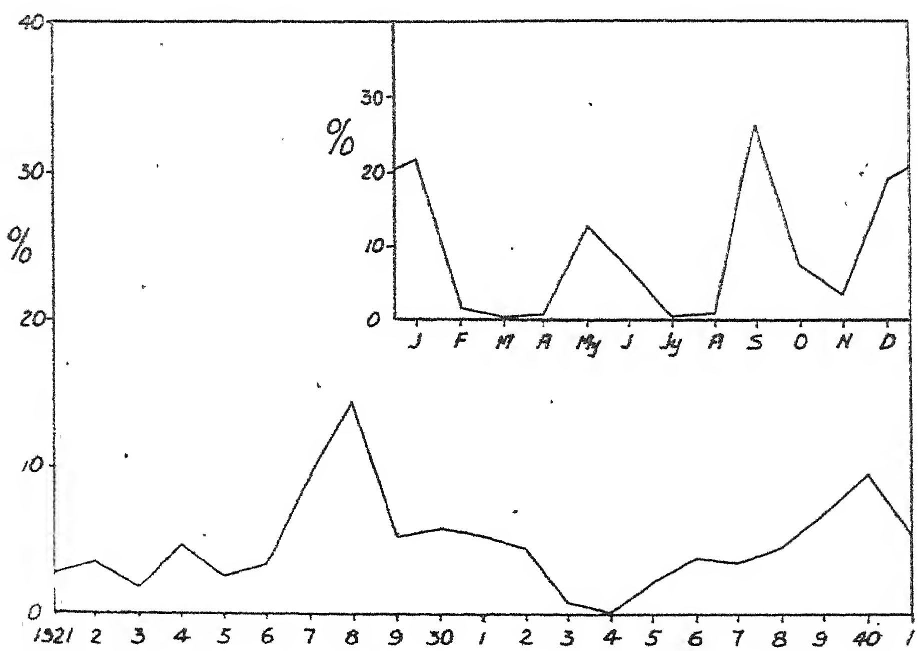

Fig. 22.—West Donegal—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

September, correspond, the winter fishery was by far the most productive in the earlier years.

At the present time, owing to the absence of English and Scottish steam drifters and consequent lack of curing facilities, the north coast fishing is carried on mainly by local boats working the autumn fishery for late spawning fish, the spring and summer fishery for spring spawning fish being in abeyance, temporarily we may hope. The latter fishery when it flourished took place in January and February for full fish preparing to spawn and in May and June for recovering spents. The principal curing stations were at Dunfanaghy, Downings, Rathmullen and Buncrana, the last named being the main headquarters for steam drifters. The fish were taken mainly from 10 to 40 miles from shore in the area from Tory Island to Inistrahull, the shoals apparently keeping to the very salt Atlantic water which does not extend further east than about the longitude of Inistrahull.

The fishery for autumn spawners has a short season, usually a few weeks in September, and is worked by open boats and small motor boats fishing drift nets a few miles from shore, or about the line of the outer headlands.

As the herrings from the coast of Donegal from Donegal Bay to Inistrahull all agree very closely in size and age it is convenient to regard them all as of one stock, or rather of two, as the distinction between spring and autumn spawners is clearly marked, and the following particulars have been compiled from samples taken over the whole of the area.

The most noticeable feature about the spring spawning fish is their large size. Except for the few years in which young herrings of an abundant year class first join the shoals, the average size is over 30 cm. (11¾ inches). The use of large meshed nets by steam drifters and large motor drifters no doubt keeps the small sizes out of the catches but, even in the ring nets, which take all sizes, the large fish predominate.

The average numbers at successive cm. lengths in samples taken over the whole period 1921-41 was :—

Length	22	23	24	25	26	27	28	29	30	31	32	33	34	35	cm.
Number	.1	.4	1.3	2.5	5.4	8.0	11.9	15.2	17.4	16.0	13.9	6.4	1.3	.1	per cent.

The average numbers of year rings deduced from samples taken over the same period, *i.e.* the average of the estimates from 21 successive years are:—

2	3	4	5	6	7	8	9	10	11	12	13	14	year rings
1.6	14.8	19.4	21.0	16.7	10.9	7.7	4.1	1.8	.9	.6	.2	.03	per cent.

As these fish were mainly hatched in spring the year rings would be formed in the following successive winters and would represent the age in years at

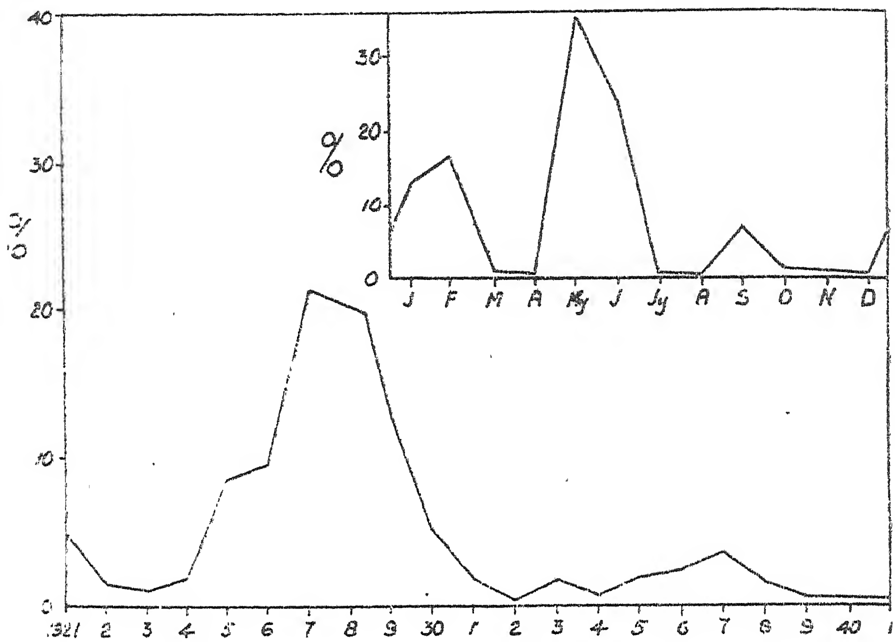

Fig. 23.—North Donegal—Catch of herrings each year shown as percentage of the total catch landed in the area from 1921 to 1941.
Inset—Average catch per cent. each month during the period 1921 to 1941.

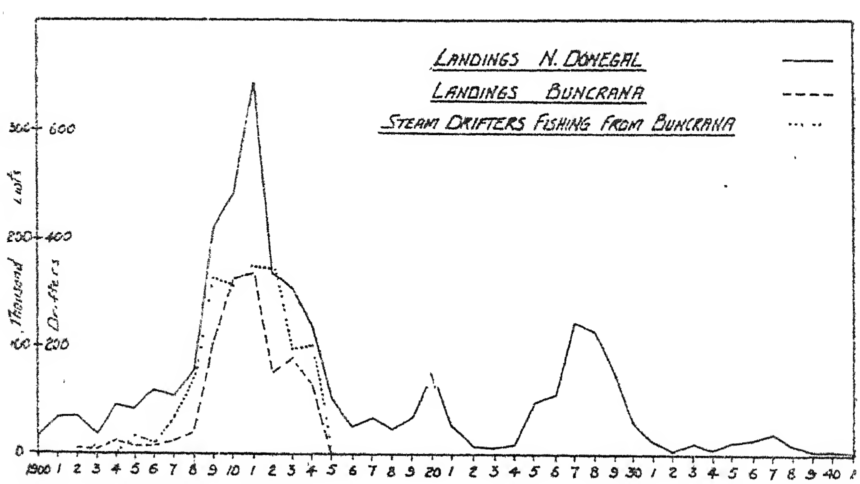

Fig. 24.—North Donegal :—
(a) Catch of herrings each year from 1900 to 1941.
(b) Landings of herrings at Buncrana from 1902 to 1915.
(c) Numbers of steam drifters landing at Buncrana from 1902 to 1915.

the beginning of the fishing season. The average age is $5\frac{3}{8}$ years as compared with $3\frac{1}{3}$ at Howth and $4\frac{1}{5}$ off Co. Waterford.

As most of the fish are taken by rather large meshed nets (28-29 meshes to the yard) there has probably been a selection of the faster growing young fish. The examination of a large number of samples taken at the beginning of the year gave the following average lengths for each age class :—

Age	3	4	5	6	7	8	9	year rings.
Length	26.7	28.3	29.8	30.6	31.0	31.9	32.1	cm.

These are the most rapidly growing fish found on any part of the Irish coast. The sizes of fish taken in summer (April to June) are intermediate between those given above.

The size of the autumn spawning fish taken in September or October is distinctly smaller than that of the spring spawners, mainly because they are younger. The following are the numbers per cent. at each centimetre length in the sample examined :—

Length	21	22	23	24	25	26	27	28	29	30	31	32	33	cm.
Number	.5	2.3	6.2	10.1	12.7	10.4	10.4	10.5	9.8	12.1	9.5	4.6	1.0	per cent.

The sizes are more uniformly distributed on an average between 24 cm. and 31 cm. than in the spring spawners, but in the separate catches they may be anything between these limits according to the type of net used, ring or drift net, the mesh of the drift net and the age of the herrings which makes up the shoals.

The average numbers of year rings on the scales of the autumn spawners are :—

1	2	3	4	5	6	7	8	9	10	11	12	year rings.
1.3	36.1	20.3	12.6	9.1	11.2	4.2	2.4	1.5	1.0	.2	.1	per cent.

As these fish are spawned in autumn it is probably exceptional for them to form a year ring on their scales the following winter, so their age may be taken as one year more than the number of rings shown on the scales. The average age of these fish would be $4\frac{3}{4}$ years.

The sizes of these fish at the completion of each year's growth have been estimated as :—

Age	3	4	5	6	7	years.
Length	25.1	27.2	28.9	30.1	30.8	cm.

As a large proportion of these fish are taken in seines or small meshed drift

nets it seems likely that there has not been the same selection of the more rapidly growing young fish as in the case of the spring spawners and that the actual sizes of both groups at each age are more nearly alike than the figures indicate.

The total catch on the N. Donegal coast from 1921-1941 amounted to approximately 580 thousand cwts. This was by far the highest amount recorded for any one locality in the period.

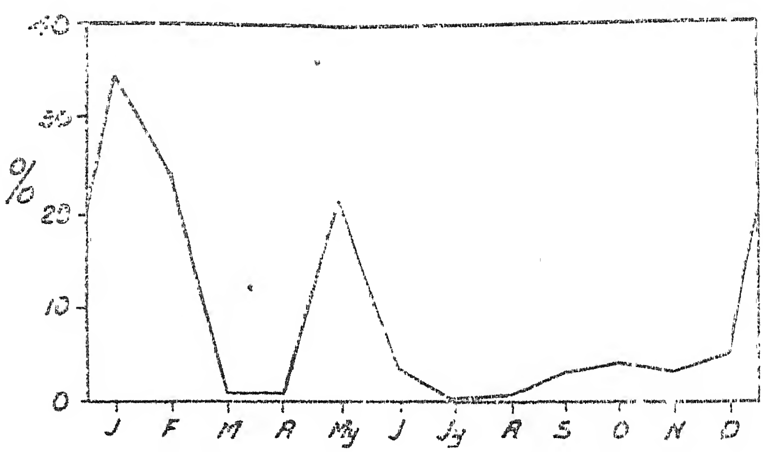

Fig. 25.—North Donegal—Average catch per cent. each month during the period 1900 to 1914.

NOTES ON THE LEAF ROLL AND MOSAIC DISEASES OF POTATOES IN RELATION TO SEED POTATO PRODUCTION.

By

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The following notes are a slightly amended form of those prepared by the above authors in 1940, and issued by the Department of Agriculture, Dublin, for the benefit of their Potato Inspectors. Except where otherwise stated, the observations contained in these notes, while not all original, are all based on personal experience.

LEAF ROLL.

The salient points regarding this disease, which is comprehensively treated in Leaflet 29, published by the Department of Agriculture, may be summarised as follows :—

(1) The symptoms are of the same general type in all varieties and two stages are recognised : (a) *Primary leaf roll,* which follows the initial infection of a healthy plant. The topmost leaves develop a stiff upward rolling, become tough and yellowish in colour and sometimes show a purple pigmentation of the under surfaces. (If infection occurs late in the season, these foliage symptoms may not be obvious.) (b) *Secondary leaf roll,* which appears in plants grown from infected tubers and is the better-known form of the disease. Here the invariable symptom in all varieties is the toughening and rolling of the basal leaves of the plant. This may be accompanied by a reduction in vigour, a loss of normal green colour and a degree of rolling in the upper leaves which varies according to the variety of potato. Dry conditions aggravate the symptoms.

(2) The leaf roll virus is readily conveyed from plant to plant by certain kinds of greenfly, the principal of which is *Myzus persicæ.* Infection occurs with particular ease when tubers are in the sprouting stage so that greenfly should never be permitted in the sprouting boxes.

(3) No variety has yet been found which is immune to leaf roll but all varieties are not equally susceptible in the field.

(4) Since the effect of leaf roll is to reduce the amount of starch translocated from the leaves to be stored in the tubers it follows, generally speaking, that the more extensive the rolling the greater will be the reduction in yield of tubers.

(5) An essential factor for the control of leaf roll is the elimination, not alone of infected plants but also of the stocks in which they occur. This involves careful examination of varieties which are mild reactors to the virus and in which infection might be overlooked.

In Leaflet 29, potato varieties are divided into three broad groups according to their reactions to leaf roll. The extended lists of varieties in these groups are as follows :—

Group I—*Least affected.*
Shamrock, Ulster Monarch, Great Scot, Skerry Champion, Up-to-Date, Di Vernon, Lochar, Irish Queen, Flourball, Arran Banner.

Group II—*Moderately affected.*
Duke of York, May Queen, Epicure, Arran Comrade, Edzell Blue, British Queen, Herald, Majestic, Gladstone, Arran Signet, Arran Victory, Kerr's Pink, Champion, Arran Chief, Arran Peak.

Group III—*Severely affected.*
Arran Crest, Dunbar Cavalier, Dunbar Standard, King Edward, Golden Wonder, Redskin, Black Skerry, Arran Consul, President.

Great Scot (Fig. 1) may be taken as the type of Group I, British Queen (Fig. 2) of Group II, and President (Fig. 3) of Group III. The groups, however, grade into one another and the varieties within each group are arranged more or less in order of severity beginning with the least affected in each case.

Apart from the manner in which they react to leaf roll, certain varieties appear to be more susceptible than others in the field. Examples of very susceptible varieties are Arran Cairn, Arran Consul, Arran Pilot, Arran Signet, Dunbar Cavalier, and Up-to-Date; somewhat less susceptible are British Queen, Golden Wonder, Great Scot and Kerr's Pink. Varieties which seem to resist infection are Skerry Champion, Shamrock, Arran Banner, Champion, Doon Star and Majestic.

It has not been shown that any of the varieties grown in this country can be infected with leaf roll without showing symptoms.

Fig. 1.– Typical Leaf Roll in Great Scot; rolling confined to lower leaves

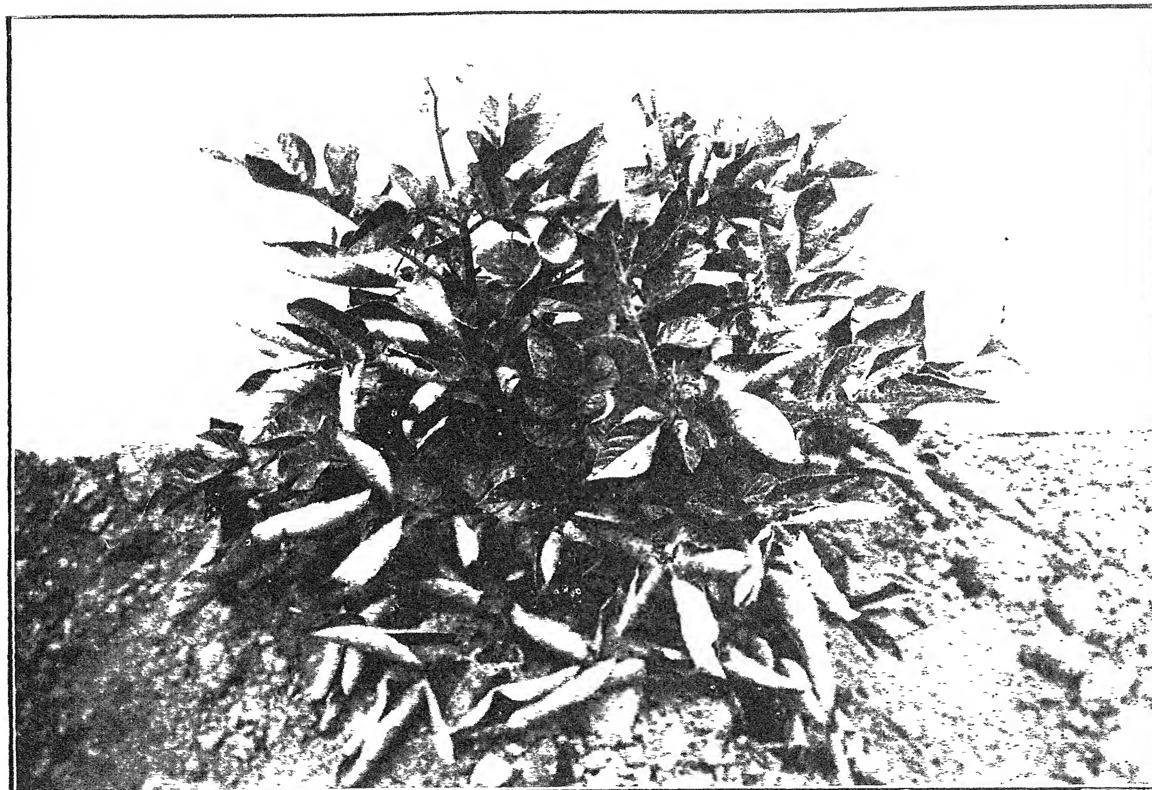

Fig. 2.—Typical Leaf Roll in British Queen.

MOSAIC DISEASES.

The term mosaic is applied to those virus diseases the symptoms of which consist primarily of irregular pale or yellowish areas on the otherwise green leaves which consequently present a mottled appearance. Various other effects, such as puckering, wrinkling and reduction in size of leaflets may accompany the mottling. The problem of the mosaic diseases is complicated by the fact that they are caused by a number of distinct viruses; in order that the best control of these diseases may be achieved, it is essential that those connected with the production of seed potatoes should have some knowledge of the viruses concerned.

Six different viruses are known to be responsible for the mosaic diseases in this country, but two of these (F and G) are only common in certain varieties and are relatively unimportant from the practical point of view. Alphabetical letters have been used to designate the viruses in recent years and are suitable for the present purpose but the more important synonyms are also mentioned.

Virus X (Solanum virus 1; Simple Mosaic Virus; Latent Mosaic Virus).
Virus B (Solanum virus 4; Up-to-Date Streak Virus).
Virus A (Solanum virus 3).
Virus Y (Solanum virus 2; Leaf-drop Streak Virus; Veinbanding Virus).
Virus F (Solanum virus 8; Tuber Blotch Virus; Pseudonetnecrosis Virus).
Virus G (Solanum virus 9; Aucuba Mosaic Virus).

Besides occurring separately, certain of these viruses are often found together in the same plant, the usual combinations and popular names of the diseases which they cause being as follows :—

X + A—Crinkle
X + Y—Rugose Mosaic
X + F—Interveinal Mosaic

Experiments have shown that the response to infection with the viruses mentioned above is not always a mosaic disease. Depending upon the variety of potato a given virus may produce (*a*) no visible symptoms, in which case it is said to be "carried" or "latent," (*b*) a visible mosaic and (*c*) in the case of viruses X and A, a so-called *top-necrosis*. The word "necrosis" here signifies the death of plant tissues which turn brownish or black; "top-necrosis" indicates that the tips of the shoots in the region of the growing points are killed, following which the entire plant usually succumbs. Plants reacting in this way are said to be *intolerant* to the virus in question. The significant point is that top-necrosis is not usually seen in the field; it is produced artificially by stem-grafting but apparently under natural conditions it is difficult for a virus to establish itself in a plant which reacts in this manner. It follows, therefore, that varieties which are intolerant to a virus do not normally

contract that virus in the field and for practical purposes may be described as "field-immune," although not actually immune in the true sense of the word.

The following varieties are intolerant to typical virus X and accordingly are free from this virus in the field, irrespective of the conditions under which they are grown :—Arran Crest, Early Regent, Epicure, King Edward, and Ninetyfold.

The following varieties are intolerant to Virus A :—

Abundance	Dunbar Standard
Arran Cairn	Dunbar Yeoman
,, Crest	Early Rose
,, Peak	Eclipse
,, Pilot	Epicure
,, Scout	Gladstone
Ballydoon	Great Scot
Beauty of Hebron	King Edward
British Queen	Ninetyfold
Doon Early	Redskin
,, Star	Sharpe's Express
Duke of York	Ulster Monarch
Dunbar Archer	Up-to-Date
Dunbar Rover	

It should be emphasised that this resistance to virus infection by natural means only holds in cases where the necrosis specifically attacks the tops of the shoots, for necrotic lesions are frequently seen on virus-infected plants in the field and may be sufficiently numerous to cause destruction of the leaves; the growing points, however, are not involved and the effect is not lethal to the plant as a whole. Incidentally, the term "streak" is now used in a general way to denote necrotic symptoms of all types, and must not be regarded as a name applicable to any particular virus.

The following notes will indicate the effects and relative importance of the principal mosaic viruses :—

Virus X :—No insect vector has yet been discovered but the virus spreads in the field by contact between the leaves of adjoining healthy and infected plants. Experiments have shown that the amount of infection occurring in "contact" plants may be upwards of fifty per cent.

Symptoms :—Different strains or forms of virus X exist in Nature which manifest themselves by the varying degrees of severity of the mosaic symptoms produced. It has been recognised for a considerable time that a mild

Fig. 3.—Typical Leaf Roll in President : stunting and rolling are particularly severe in this variety.

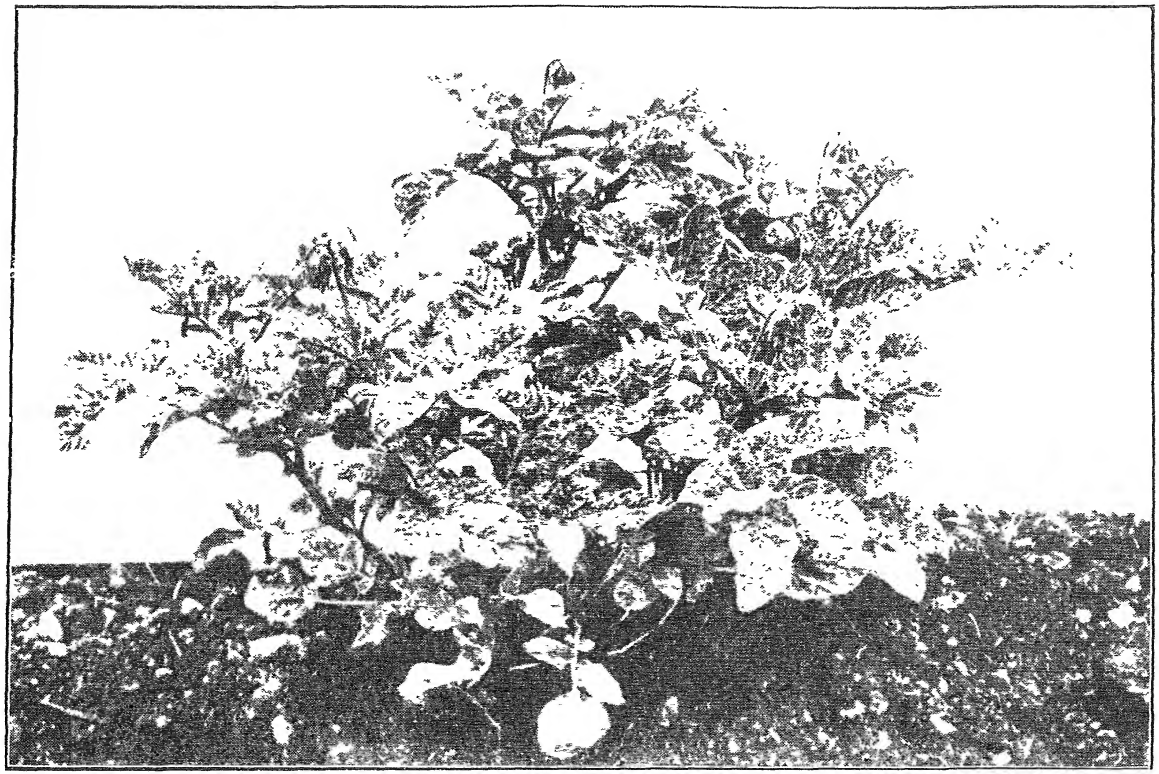

Fig. 4.—Sever strain of virus X in president. (Note resemblance to Crinkle, Fig. 5).

form of X may be present in potato plants which produces no visible symptoms, except perhaps a faint evanescent mottling of the leaves at certain periods of growth—hence the name "latent mosaic." Other strains of X are characterised by a visible mottling (Fig. 5) which varies in intensity from moderate to strong according to the strain, and in the more pronounced types is often accompanied by isolated necrotic spots on the leaves. It is only recently that the existence of an exceedingly virulent strain of X has been recognised (Fig. 4). The symptoms in this case consist of a brilliant mosaic mottling of the leaves ; the leaflets are crinkled and reduced in size and develop numerous dry brown lesions which increase to such an extent on the lower leaves of the plant that the latter wither and drop off (this effect is accentuated by dry conditions). In addition, the entire plant is stunted and the yield of tubers considerably reduced. The symptoms are similar whether the plants be in the first or second year of infection except that in the second year the leaves show less tendency to drop but are covered with brown "rusty" necrosis. After the third or fourth year of infection there is an unusual development in that the plants recover from the severe disease and show only a mild mosaic.

The disease at certain stages is not easy to distinguish from Crinkle (X + A), except, perhaps, by the more extensive necrosis which it produces on the leaves. In the initial leaf-drop stage it might also be confused with the disease caused by virus Y, but the brilliant mosaic which subsequently develops renders it easily distinguishable from the latter. This virulent strain of X has been isolated from field plants of the varieties Arran Banner, Arran Pilot, Arran Signet, British Queen, Dunbar Rover, Dunbar Standard, Kerr's Pink and Majestic; its effects on many other varieties have been tested and found to be severe in all cases. Excepting virus B, mentioned below, all strains of X induce top-necrosis in the five varieties already listed as intolerant, this reaction depending entirely upon the variety of potato and not upon the intensity of the strain of X involved.

Tuber Symptoms :—Virus X produces no visible symptoms in the tubers of those varieties which react to it with a mosaic mottle (whether the latter be mild or severe) but nevertheless they are infected and give rise to diseased plants. Plants of intolerant varieties in which top-necrosis is produced yield very few tubers and when these are invaded by the virus they develop severe necrotic lesions which involve the eyes. They usually dry up and shrivel in storage but if any sprouts are produced they are sick and weakly and die prematurely.

General Remarks :—Owing to the severity of the symptoms, it is unlikely that plants infected with the virulent strain of X will escape detection by the seed potato grower. Assuming that the virus has no insect vector, the immediate removal of diseased plants and of those immediately in contact with them should serve to check the spread of the virus in the crop. The

removal of healthy-looking plants adjacent to the diseased one is extremely important as it has been found that plants which become infected by contact rarely show disease symptoms in the current year of infection. On the other hand, X in the latent state can scarcely be diagnosed in the field and is therefore propagated through the tubers from year to year, besides spreading to previously healthy plants by contact of the foliage. Consequently it is the most widespread of all the potato viruses. The entire stocks of such well-known varieties as Up-to-Date and Duke of York are infected with X (usually latent or mild but which may show up plainly enough) and the virus is liable to be present in field crops of any variety except an intolerant one.

The detrimental effect of latent X on the foliage is so slight that this strain of the virus might be regarded as practically harmless in itself; although tests carried out in other countries indicate that mild X disease may cause a reduction in yield of about twenty per cent. It is known that plants infected with one strain cannot be re-infected with *another strain of the same virus* so that Up-to-Date, for example, being a carrier, will not contract infection with the virulent strain of X which has been described. In so far as it exercises this protective role, the presence of latent X in a plant is beneficial; it is potentially dangerous, however, for should infection with a *different virus* take place, the symptoms of the latter will be aggravated by the prior presence of the X. Indeed, the combination of viruses X and A has been one of the commonest causes of potato degeneration in this country. Furthermore, it is becoming increasingly evident that strains of X are capable of changing from one form to another within the tissues of the potato plant; so that a plant may be infected with a mixture of X strains and the possibility must be considered that a mild strain might, under certain conditions, become virulent. According to present knowledge, however, the reverse occurrence is the more usual.

In certain quarters it is contended that the control of virus X is impracticable; elsewhere, the suggestion has been made that the only successful method lies in the use of intolerant varieties, and attention is being directed to the breeding of such types. This, however, is a slow process and in the meantime it is recognised that the most effective method is that adopted in this country, *viz.*, the building up of seed potato stocks from tubers which have been tested experimentally and shown to be free of all viruses, including virus X. There is evidence that such stocks can be maintained free from X for several years provided contact with infected crops or volunteer plants is prevented.

Virus B :—Is widespread in Up-to-Date, Duke of York and in most American commercial varieties. It has recently been shown that this virus is simply another strain of virus X, differing from the typical strains only in its reactions on certain potato varieties. It appears usually to be accompanied by one or other of the typical X strains.

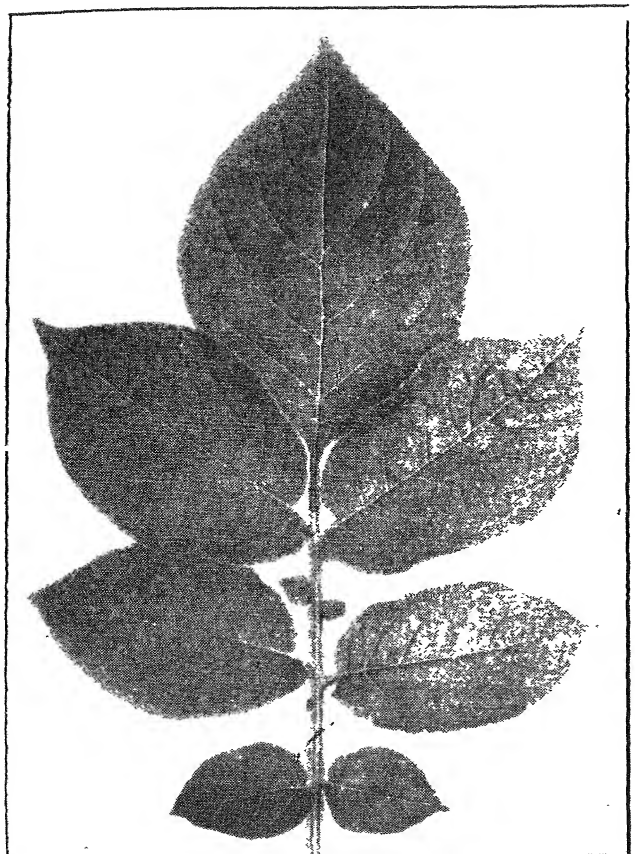

Fig. 5. —Mild strain of virus X. (Simple mosaic) in leaf of President

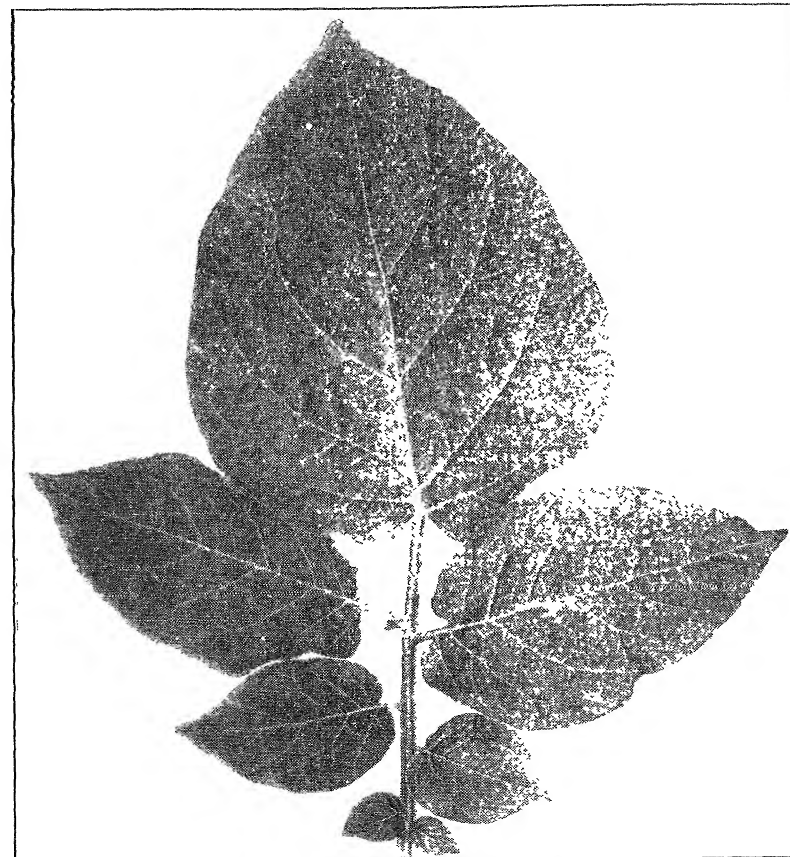

Fig. 6.—Virus A in Arran Victory leaf showing as a faint venial mottle.

Fig. 7.—Crinkle in President to due a combination of viruses X and A.

Artificial infections have shown that B induces a lethal top-necrosis in many varieties of potato (which accordingly are "field-immune" to it) and is carried almost without symptom in the remainder. From the practical point of view, therefore, this virus is to be regarded as a mild strain of X, occurring only in certain varieties (those tolerant to it) in the field, but the spread and control of which in these varieties will be similar to that of a typical X strain. Because of its association with Up-to-Date and the top-necrosis effect which it produces on many varieties, the virus was formerly known as "Up-to-Date Streak" but this name is no longer used. The following is a list of varieties intolerant to virus B as shown by artificial stem-grafting experiments:

Abundance	Doon Early
Arran Cairn	Dunbar Standard
,, Chief	,, Yeoman
,, Comrade	Golden Wonder
,, Pilot	Kerr's Pink
,, Scout	May Queen
,, Victory	President
Ballydoon	Sharpe's Express
British Queen	Ulster Monarch
Catriona	

Carrier varieties are:—

Arran Banner	Duke of York
,, Consul	Earliest of All
,, Peak	Eclipse
,, Signet	Gladstone
Champion	Great Scot
Di Vernon	Majestic
Doon Star	Redskin
Dunbar Cavalier	Up-to-Date
,, Rover	

It is interesting to note that the varieties Arran Crest, Epicure and King Edward, which are intolerant of all other strains of X, have been shown by Scottish workers to be tolerant to the B strain.

VIRUS A:—Is transmitted by the greenfly, *Myzus persicæ*, and this is probably the only method of spread in the field.

FOLIAGE SYMPTOMS:—As seen under natural conditions these vary slightly from one variety to another but, on the whole, are distinctly mild. They consist of a faint light and dark green mottling, sometimes accompanied by a slight marginal undulation of the leaves (Fig. 6). The effect is very similar to that of the milder strains of X except that the pale areas appear to spread from the veins and the mottle is of a more diffuse character; at certain periods

of the growing season the mottle may fade completely in some varieties. There is some evidence that different strains of virus A may exist but only a mild type has been recognised in this country.

Artificial infection by stem-grafting has shown that twenty-five varieties react to virus A with top-necrosis and do not show infection in the field. (The list of intolerant varieties has been given above).

TUBER SYMPTOMS :—The tubers from naturally infected plants showing mosaic symptoms appear perfectly normal but give rise to diseased plants. When the reaction is a top-necrosis, as in the intolerant varieties, the tubers develop necrotic lesions. In certain cases these involve the eyes and the tubers are destroyed; in others, the virus is isolated in small necrotic areas in the flesh of the tubers where it is apparently killed out for the buds are not invaded and the tubers give rise to healthy plants.

General Remarks. The danger of virus A lies in the fact that in combination with virus X (even the latent strain) it forms Crinkle, which is a serious disease. The control of the virus is not easy on account of the fact that it is spread by greenfly and in addition is sometimes difficult to diagnose in the field. It has been said that the reaction to A determines the life of a variety in this country and it is fortunate that many of the new varieties are intolerant to it.

The virus has been present in Ireland for a considerable time for stocks of the old Champion which are still in existence are permeated with it (and frequently with virus X as well). The varieties Golden Wonder and Irish Chieftain are infected throughout with A and, according to Scottish workers, the same may be said of their stocks of Arran Chief and Catriona, although a healthy stock of the latter is available here. It is obvious, therefore, that stocks of these varieties should not be grown in the vicinity of potato crops of other varieties which are susceptible to A, especially in districts where greenfly are prevalent.

VIRUS Y :—Is freely transmitted by *Myzus persicæ* and other species of greenfly, and probably by contact between healthy and infected plants as well. It ranks with leaf roll as one of the most destructive of the potato viruses.

Foliage Symptoms. These vary somewhat according to the variety but the majority of varieties react in the following manner :—

In the first year of infection a blotchy mottle, spreading from the veins, appears on the topmost leaves of the plant. This usually tends to become diffuse, producing an effect of general chlorosis rather than a clear mosaic pattern ; the surfaces of the leaves assume a roughened or rugose appearance and the leaflets turn downwards at the edges ; in addition they exhibit a

Fig. 8.—Crusader showing Leaf Drop Streak.

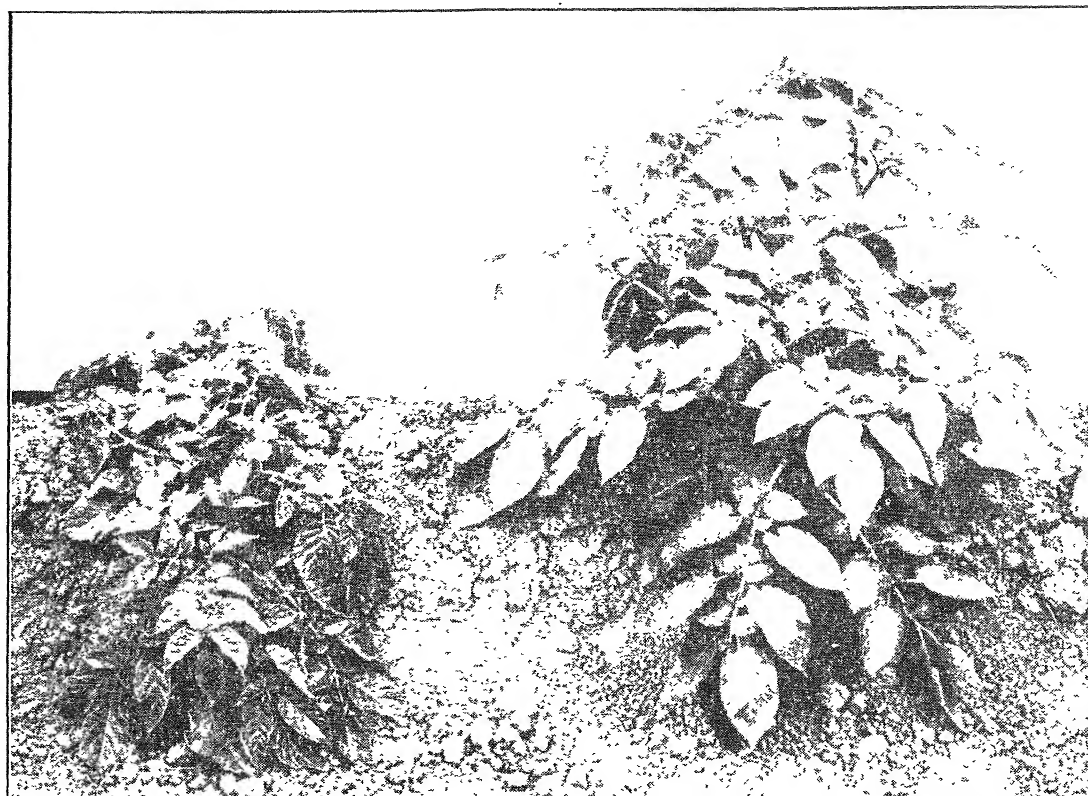

Fig. 9.—Healthy plant of Arran Crest (right) and plant infected with Virus Y. Note prostrate habit of growth.

definite sheen while both leaves and stems become extremely brittle. Meanwhile, black necrotic streaks appear on the undersides of the veins of the lower leaves and in due course these extend down the petioles until they reach the main stem ; the leaves then collapse and wither and remain hanging on the stem until dislodged by the wind. This is the condition known as "leaf-drop streak" (Fig. 8). The extent of the leaf drop varies more or less according to the variety and is aggravated by dry conditions. It is not unusual to find Y-infected plants, the stems of which are completely bare except for a tuft of leaves at the top. The weakness of the stems results in a prostrate habit which, indeed, is a conspicuous feature of the symptoms.

The following varieties react more or less in the manner described above ; those of group (*a*) usually showing more pronounced "leaf-drop streak" than those of group (*b*) :

(*a*)	Arran Consul	Gladstone
	Ballydoon	Kerr's Pink
	Doon Star	Majestic
	Dunbar Yeoman	President
	Eclipse	

(*b*)	Arran Banner	Early Rose
	,, Cairn	Epicure
	,, Chief	Great Scot
	,, Pilot	King Edward
	,, Signet	Redskin
	Doon Early	Sharpe's Express
	Duke of York	Ulster Monarch
	Dunbar Cavalier	Up-to-Date
	,, Standard	

In the second year of infection, that is, in plants grown from infected tubers, the symptoms are usually milder owing to the absence of the "leaf-drop streak" effect. Otherwise they resemble those of the previous year, the characteristic features being the rugosity, chlorosis and glazed appearance of the foliage, the brittleness of leaves and stems and the spreading habit of growth. In addition, a shortening of the internodes results in a stunting effect in many cases. Varieties on which the symptoms are distinctly milder in the second year are :—Arran Banner, Arran Chief, Arran Signet, Champion, Doon Early, King Edward and Redskin.

There are four varieties which do not develop any leaf drop or necrotic symptoms even in the first year of infection with Y. They are Di Vernon, Arran Crest (Fig. 9), Arran Victory and Catriona. The first named is said to be

a carrier (the variety has not been tested here); the remaining three show a diffuse mottle and the margins of the leaflets are wavy; there is a slight reduction in vigour and a tendency to a sprawling habit of growth. On the whole, however, the symptoms are comparatively mild.

Tuber Symptoms. The tubers from infected plants are apparently sound although sometimes small and misshapen. According to the severity of the foliage symptoms, the yields may be considerably reduced. Infected tubers always produce diseased plants.

General Remarks. Virus Y is comparatively rare in this country in the good seed potato districts, but it causes great destruction in England, particularly in the Midland and Southern districts where insect vectors are abundant. Since the necrotic effects of Y do not involve the growing points or vascular tissues of any variety there is no question of "intolerance" and consequent "field immunity," and all varieties are liable to infection under natural conditions. In view of the ease with which this virus is transmitted by greenfly, the problem of its control is similar to that of leaf-roll and is equally urgent. In the course of inspection, special attention should be given to those varieties which are mild reactors to the virus and it would be particularly dangerous to pass over an ordinary mottle in *Arran Crest*, *Epicure* or *King Edward*, for all three are intolerant to viruses X and A and any mosaic of virus origin would almost certainly be a manifestation of virus Y.

VIRUS F:—May be spread by contact between healthy and infected plants and also, under special circumstances, by *Myzus persicæ*.

Symptoms. The symptoms produced on the foliage by this virus are only noticeable in certain early varieties such as May Queen, Ninetyfold and Arran Crest. The young shoots of infected plants of these varieties appear distorted on coming above ground; the leaflets are twisted and curl downwards and superficial necrosis of the main veins and petioles prevents their normal expansion. These effects are confined to the first formed leaves and later growth is normal, except perhaps for the development of small circular yellow spots on the lower leaves. In other potato varieties, foliage symptoms are confined to a mild yellow spotting of the basal leaves, which is not consistent in its development, and the vigour of the plants seems unimpaired. The tubers of certain varieties, however, show a distinct necrotic reaction which develops during storage and usually begins at the heel end (Fig. 10). The injury may be manifested externally by the appearance of irregularly-shaped brown patches which later become dry and sunken; on cutting, the flesh underneath these patches is found to be necrotic and, in addition, brown lesions are usually present in the pith; sometimes the necrosis is confined to the pith and there are no external symptoms. The eyes are not affected and sprout normally.

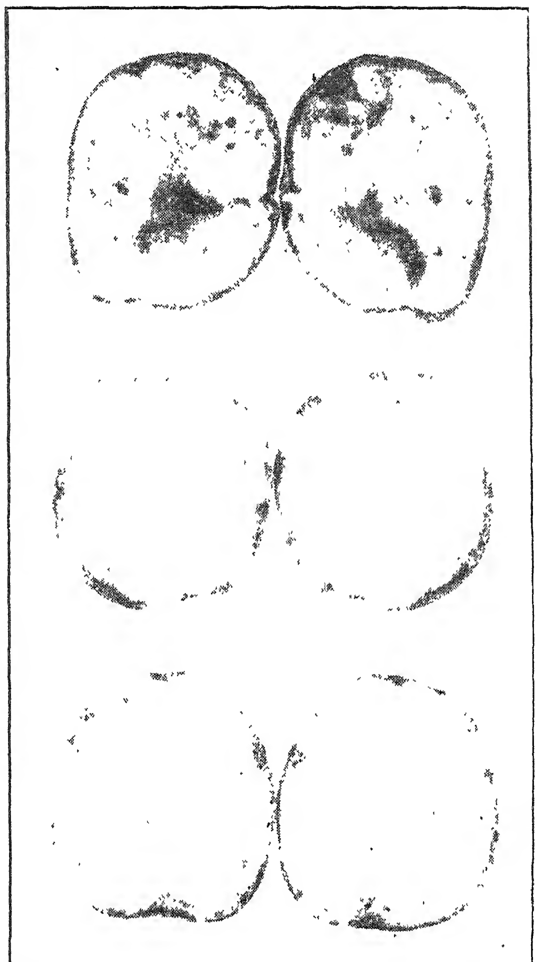

Fig. 10.—Cut tubers of President showing types of necrosis caused by virus F.

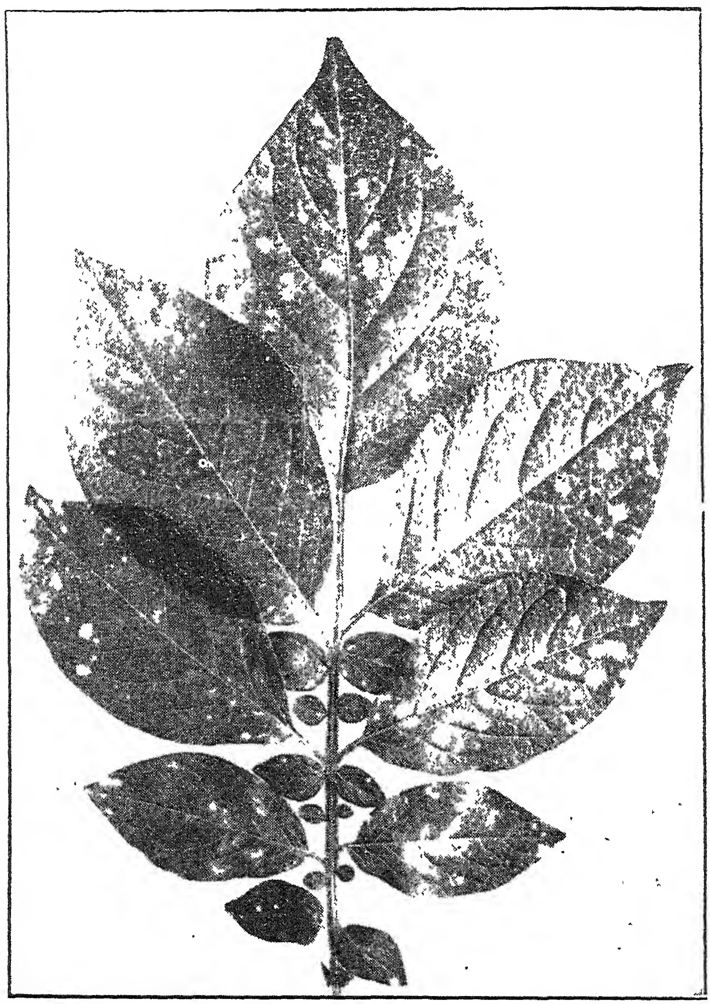

Fig. 11.—Leaf of Early Regent showing Aucuba mosaic due to virus G.

The following varieties showed tuber necrosis on infection with virus F :—

Arran Consul	Dunbar Yeoman
,, Signet	Gladstone
,, Victory	Great Scot
British Queen	Majestic
Champion	President
Duke of York	Redskin
Dunbar Cavalier	Ulster Monarch
,, Standard	Up-to-Date.

Varieties which failed to show necrosis were :—

Arran Banner	Doon Early
,, Cairn	,, Star
,, Crest	Early Regent
,, Peak	Fortyfold
,, Pilot	Kerr's Pink
,, Scout	King Edward
Ballydoon	May Queen
Catriona	Ninetyfold
Di Vernon	

General Remarks. Virus F is only common in the early varieties May Queen, Fortyfold and Ninetyfold. It is not believed to be of economic importance in this country, although possibly to some extent it is responsible for the condition known as "Spraing." Although in most varieties the virus of itself has practically no effect on the foliage, a combined infection of Viruses X and F results in a pronounced mosaic even if the strain of X is a mild one.

The precaution to be taken in regard to this virus is to avoid planting tubers showing necrosis of the type described, even though the buds are normal.

VIRUS G :—Is very closely related to virus F and the two may be placed in the same category. It has not been shown to be insect transmissible but could be spread by contact. The symptoms are of similar type in all varieties, consisting of conspicuous bright yellow spots or blotches mainly on the lower leaves of the plant (Fig. 11). This disease is known as *aucuba mosaic* because the mottling resembles that of *Aucuba japonica* (variegated laurel). There is no apparent reduction in vigour of infected plants. All varieties are liable to infection under natural conditions but very little spread appears to take place.

Tuber symptoms consist of a necrosis which is similar to that caused by

virus F but does not appear in all the varieties affected by the latter. Common varieties known to show tuber necrosis with virus G are :—

British Queen, Champion, Dunbar Yeoman, Great Scot, Majestic and President.

Virus G is widespread in the old variety Early Regent and probably occurs also in the varieties already mentioned as being subject to virus F. It is not known to occur in newer varieties in this country.

DISEASES DUE TO COMBINATIONS OF VIRUSES.

CRINKLE (X + A) :—The principal features of this disease are the puckering and reduction in size of the leaflets and the occurrence of pale or yellowish patches on the veins which extend irregularly into the interveinal areas and thus produce a conspicuous mosaic effect (Fig. 7). The chlorotic tissues fail to develop to the same extent as the green areas which consequently bulge upwards and the characteristic irregularity of the leaf surface results. Dry, brown, "rusty" patches frequently occur in the yellow areas of the leaves. Crinkle has a stunting effect on the plants and the tubers are considerably reduced in size and number although otherwise not visibly affected.

Crinkle is one of the commonest forms of "mosaic disease" in Ireland and Scotland, and was responsible for the degeneration of the old Champion in this country. Owing to the differences in the mode of transmission of the two viruses concerned, perfectly healthy plants will require two separate infections for the production of the disease; the apparently sudden collapse of crops with crinkle results from the growing of stocks infected with latent X in districts where sources of virus A together with its greenfly vector are present. The superiority of genuinely X-free stocks of susceptible varieties over those which look healthy but contain latent X is therefore obvious.

Varieties which are intolerant to either X or A will not show crinkle although in the latter the virulent strain of X alone might be mistaken for crinkle. It will be noticed that some of the best long-lived varieties fall into this category, *e.g.*, British Queen, Up-to-Date, Early Rose, Kerr's Pink and King Edward.

Well-known varieties which are subject to Crinkle are :—

Arran Banner	Di Vernon
,, Chief	Dunbar Cavalier
,, Consul	Golden Wonder
,, Comrade	Irish Chieftain
,, Victory	Majestic
Catriona	President
Champion	

Rugose Mosaic (X + Y) :—The symptoms of the composite disease are of the same type as those of virus Y alone. The presence of the X, however, induces a much more pronounced mosaic pattern in the foliage and considerably aggravates the rugosity and stunting of the plants in the second year of infection ; in extreme cases, a "curly dwarf" condition may be produced. Varieties which are mild reactors to Y show pronounced crinkle-like symptoms with the additional X infection.

The disease is liable to occur in any variety except those few which are intolerant to X. It is one of the commonest diseases in America where virus Y is prevalent and commerical varieties are all carriers of X.

Interveinal Mosaic (X + F) :—The disease due to this combination was originally recorded in Holland and was also discovered in this country. Any variety, except one intolerant to X, would be liable to contract the infection but owing to the infrequent occurrence of virus F, the disease is not common here.

The symptoms consist of a bright mosaic mottle all over the leaves, but the latter are not distorted in any way. Small, rounded yellow spots or dry "rusty" lesions are present on the lower leaves, and tuber necrosis occurs in those varieties which develop this symptom with virus F.

SUMMARY.

All varieties of potato are susceptible to infection with leaf roll and the virus is spread freely by the greenfly, *Myzus persicæ*. Control by "rogueing" is unsuccessful and infected stocks should be eliminated. Special care should be taken in the inspection of varieties which are mild reactors to leaf roll.

The viruses chiefly responsible for the mosaic diseases in this country are X, A and Y. Certain varieties are "intolerant" to X and/or A and do not become infected with them in the field. All are liable to infection with Y under natural conditions.

Virus X alone is usually mild, but strains occur which produce severe mosaic. The virus spreads in the field by contact between the leaves of adjacent healthy and diseased plants.

Virus A is spread by *Myzus persicæ* and under natural conditions produces a mosaic effect similar to that caused by the milder strains of X.

Combined infection with viruses X and A results in Crinkle, the commonest severe mosaic disease in this country. Virus Y is spread freely by *Myzus persicæ* and causes severe effects in all but a few varieties. Infected stocks should be eliminated and care taken not to overlook mosaic symptoms in the varieties which are mild reactors. Combination with X aggravates the effects of Y.

Viruses F and G produce tuber symptoms in a number of varieties. Effects on the foliage are relatively harmless unless in combination with virus X.

Dry conditions aggravate the symptoms of leaf roll and certain mosaic viruses.

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FIELD EXPERIMENTS, 1943.

Winter wheat, oat and potato variety trials conducted by County Instructors in Agriculture in the 1943 season are dealt with in this report. Details of the trials in each county may be obtained by applying to the Secretary of the County Committee of Agriculture.

WINTER WHEAT VARIETY TRIALS.

Trials were conducted at nine centres to compare the new hybrid, Yeoman II x Ironmaster and Pajbjerg No. 5—a recent selection from commercial Pajbjerg—both of which were produced at the Albert College, Glasnevin, with Queen Wilhelmina obtained from commercial stocks.

At one centre in County Dublin the crop was severely affected by "Take-all" disease and lodged badly so that the yield of grain was not determined. The yields obtained at the other eight centres are shown in Table I together with the types of soil on which the crops were grown, the previous crops, dates of sowing and incidence of yellow rust. Manure was not applied to the plots at any centre.

The seed was of good germinating capacity in early winter and the crops sown in November produced, in the case of the three varieties, a good braird which continued to make satisfactory growth. Reports from three of the centres, however, indicated that Yeoman II x Ironmaster made less vigorous early growth than the other two varieties.

At the four centres where the seed was sown in February, Yeoman II x Ironmaster produced a weak braird. Plant establishment was estimated at about 75 per cent. that of a full crop in Louth and Wexford S. (centre No. 2) and at about half normal in Wexford S. (centre No. 1) and at both centres in Wexford N. At the latter two centres, this plot was considered, during the early stages of growth, to be a partial failure. Pajbjerg No. 5 and Queen Wilhelmina also produced weak brairds at the Louth centre, but plant establishment was about normal and subsequent growth was satisfactory and noticeably better than that of Yeoman II x Ironmaster. The seed of the latter variety evidently deteriorated in germinating capacity, during storage at these four centres to a greater extent than the seed of Pajbjerg No. 5 which was delivered at the same time.

Leatherjacket grubs caused some damage to the crops at Wexford N. centres and the Yeoman II x Ironmaster plot was stated to have suffered the most injury as a result. No appreciable amount of lodging occurred at any of the eight centres.

TABLE I.

County	Description of Soil	Previous Crop	Date of Sowing	Yield of Grain per Statute Acre: Queen Wilhelmina c.	q.	Yeoman II x Ironmaster c.	q.	Pajbjerg No. 5 c.	q.	Incidence of Yellow Rust
Dublin	Medium Loam ..	Mangels	26/11/42	32	2	31	3	37	3	Three varieties slightly affected.
Louth	Fairly heavy loam ..	Pasture	15/ 2/43	25	3	25	3	26	3	Three varieties severely affected.
Meath N. ..	Gravelly loam ..	Roots ..	20/11/42	30	0	25	2	27	2	Negligible.
Meath S. ..	Clay loam	Mangels	20/11/42	25	3	25	1	27	0	Slight attack on Queen Wilhelmina, negligible on others.
Tipperary S.R. ..	Medium Clay ..	Potatoes	25/11/42	22	0	20	0	23	3	Three varieties affected.
Wexford N. ..	Light friable loam ..	Lea Oats	13/2/43	17	2	14	2	20	1	Queen Wilhelmina severely affected; slight attack on Pajbjerg No. 5; none evident on Yeoman II x Ironmaster.
Wexford S. ..	(i) Medium clay loam	Pasture	16/2/43	28	0	25	0	34	2	Negligible.
	(ii) Medium clay loam	Sugar beet	25/2/43	28	2	28	0	27	0	Three varieties affected, but Yeoman II x Ironmaster noticeably the least so.
		Average Yield ..		26	1	24	2	28	0	

Yeoman II x Ironmaster was about four days later in ripening than Pajbjerg No. 5 and seven days later than Queen Wilhelmina in Co. Louth and about four days later than the other two varieties in Wexford N. The three varieties ripened at approximately the same time at the other six centres.

The quality of the grain was generally good. At one centre the grain of Queen Wilhelmina was badly sprouted at time of threshing while at another centre Pajbjerg No. 5 and Yeoman II x Ironmaster were stated to be of poor colour and to contain a high proportion of badly filled grains.

In these trials Pajbjerg No. 5 gave good results while Yeoman II x Ironmaster proved inferior to the other two varieties.

OAT VARIETY TRIALS.

Glasnevin Success X, which is a recent selection, produced at the Albert College, Glasnevin, was compared with Victory II at fifty-three centres in twenty-six counties.

The seed of the Glasnevin Success X was supplied from the Albert College and that of the Victory II from the Department's Cereal Station, Ballinacurra, Co. Cork.

Except at six centres manure was not applied to the plots. Germination of the seed and subsequent growth of the crops were good. Reports from twenty-six centres indicated a difference between the varieties in the appearance of the crops during vegetative growth and of these, twenty-two were in favour of Success X. The incidence of disease and insect pests was negligible except at one centre where both varieties were affected by crown rust. At four centres bird damage to the ripening crops was appreciable. There was no apparent difference in the time of ripening of the varieties at three centres while at the remainder Success X ripened from three to fourteen days earlier than Victory II. Because of the earlier date of ripening of Success X, the loss of grain from this variety, due to bird damage where this occurred and by shedding at a few centres where harvesting was delayed by unfavourable weather, was greater than in the case of Victory II. The extent of lodging of Victory II and Success X, respectively, was negligible at twenty-nine and thirty-nine centres, slight at nine and six centres and considerable at fifteen and eight centres. Victory II lodged to a greater extent than Success X at seventeen centres while at four centres the converse was the case.

The yields of grain obtained are set out in Table II from which it will be seen that, on the average, Success X yielded 1 cwt. of grain more per statute

acre than Victory II and gave a higher yield than the latter variety at thirty-two of the fifty-three centres.

The grain of both varieties was generally of good quality but at a small number of centres, mainly where the crops lodged badly, it suffered some damage due to unfavourable harvest weather. Of twenty-two reports which indicated a difference in grain quality between the two varieties, half were in favour of each variety.

It would appear from these trials that Glasnevin Success X, is superior to Victory II in respect of grain yield ; that Success X, being shorter in the straw, resists lodging better than Victory II and that it ripens on the average, about a week earlier. The grain of Success X, while not so white in colour as that of Victory II, compares favourably with it in quality.

TABLE II.

County	Description of Soil	Previous Crop	Yield of Grain per Statute Acre: Victory II		Success X	
			c.	qr.	c.	qr.
Carlow	Medium granite loam ..	Grass ..	21	3	26	3
Cavan	Medium loam	Oats	17	2	23	0
do.	Loam	Turnips ..	15	0	14	2
Clare	Medium limestone loam ..	Potatoes ..	28	0	25	3
do.	Clay loam	Potatoes ..	19	1	19	0
Cork	Light loam	Oats	21	2	20	2
do.	Limestone loam	Lea Wheat ..	23	1	24	3
do.	Medium sandstone loam ..	Grass ..	28	0	30	2
do.	Medium limestone loam ..	Grass ..	23	2	28	0
do.	Light loam	Turnips ..	21	1	21	2
Donegal ..	Medium Loam	Roots ..	21	2	23	1
do.	Clay loam	Potatoes ..	20	2	21	0
Dublin	Clay loam	Grass ..	32	3	22	1
do.	Medium limestone loam ..	Swedes ..	23	2	29	3
Galway ..	Clay loam	Potatoes ..	19	0	22	2
do.	Rich heavy loam	Lea Oats ..	28	3	32	0
Kerry	Medium loam	Potatoes ..	29	0	33	0
do.	Medium loam	Grass ..	24	1	18	3
Kildare ..	Deep loam	Wheat ..	28	0	27	0
do.	Loam..	Potatoes ..	22	2	26	3
Kilkenny ..	Medium limestone loam ..	Oats	25	0	19	2
do.	Medium sandstone loam ..	Mangels ..	25	3	27	3
Laoighis	Limestone gravel loam ..	Potatoes ..	23	3	21	2
do.	Medium loam	Hay	24	1	25	3
Leitrim ...	Heavy clay	Potatoes ..	18	2	20	0
Limerick ..	Limestone loam	Wheat ..	25	0	20	0
do.	Medium heavy loam ..	Roots ..	21	0	20	1
do.	Light limestone	Potatoes ..	25	2	26	1
Longford ..	Strong loam	Turnips ..	31	0	30	1
do.	Sandy loam	Potatoes ..	30	0	25	2
Louth	Loam	Wheat ..	27	0	27	0
Mayo	Rich loam	Potatoes ..	26	3	29	0
do.	Medium loam	Potatoes ..	21	3	22	2
Meath	Deep loam	Wheat ..	24	0	16	2
do.	Clay loam	Sugar beet ..	26	0	28	1
Monaghan ..	Clay loam	Grass ..	21	0	20	1
Offaly	Medium limestone loam ..	Grass ..	32	0	36	1
do.	Medium limestone loam ..	Turnips ..	29	2	33	2
Roscommon ..	Medium loam	Potatoes ..	18	2	15	1
do. ..	Medium limestone loam ..	Potatoes ..	22	1	28	2
do.	Medium limestone loam ..	Mangels ..	20	3	30	1
Sligo	Limestone loam	Potatoes ..	23	1	23	3
Tipperary N.R. ..	Rich heavy soil	Sugar beet ..	36	2	43	0
do. ..	Clay loam	Potatoes ..	34	1	31	1
Tipperary S.R. ..	Medium clay loam ..	Wheat ..	21	0	19	0
do. ..	Medium clay loam	Sugar beet ..	23	2	22	2
Waterford ..	Medium loam	Grass ..	24	0	25	0
do. ..	Limestone loam	Grass ..	23	3	19	1
Westmeath ..	Heavy limestone drift ..	Roots ..	23	2	26	3
Wexford ..	Medium loam	Mangels ..	17	3	21	3
do.	Medium clay loam	Grass ..	22	0	25	2
Wicklow	Rich medium loam ..	Potatoes ..	18	2	20	1
do.	Medium loam	Grass ..	31	3	31	2
	Average (53 centres) ..		24	1	25	1

POTATO VARIETY TRIALS.

At seventy centres in twenty-five counties the variety Doon Eire was compared with Kerr's Pink. Doon Eire is a maincrop variety of the King Edward type and is immune from wart disease. The tuber is kidney-shaped with white flesh, white skin splashed with red, and shallow, red eyes. The sprout is pink and foliage tall, strong and upright with pink coloration in the stems. Numerous large, white flowers are produced.

From eighteen centres, at a number of which the seed tubers were cut, it was reported that an appreciable proportion of misses occurred in the Doon Eire crops while at only a couple of these centres was Kerr's Pink also stated to have missed to an appreciable extent. At two centres in Co. Kilkenny Doon Eire failed due to dry rot after planting and yields were not determined.

At fifteen centres the foliage of Doon Eire was stated to have persisted in growth later in the season than did that of Kerr's Pink. Reports, in general, however, indicated that Doon Eire suffered more damage from blight, and as may be seen from Table III, the proportion of blighted tubers in this variety was relatively very high at the majority of the centres. The Doon Eire plants tended to form large tubers near the surface of the soil, a factor which increases the danger of infection by blight unless moulding is well done.

The average yields from sixty-eight centres indicate that Kerr's Pink produced 23 cwts. total crop or 26 cwts. more ware per acre than Doon Eire.

Reports on table quality indicated that Doon Eire was inferior in this respect to Kerr's Pink.

TABLE III.

County	Plot	Yield of Tubers per Statute Acre							
		Doon Eire				Kerr's Pink			
		Ware	Small	Diseased	TOTAL	Ware	Small	Diseased	TOTAL
		t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.
Carlow	—	8 11 2	0 12 0	3 4 0	12 7 2	15 0 1	0 11 3	0 0 0	15 12 0
Cavan	1	6 10 0	1 2 0	2 0 0	9 12 0	6 14 0	3 4 0	0 12 0	10 10 0
do.	2	3 6 0	0 18 0	2 12 0	6 16 0	8 6 0	2 4 0	0 10 0	11 0 0
do.	3	7 2 1	0 5 2	1 8 1	8 16 0	13 10 0	0 17 0	0 1 2	14 8 2
Clare	1	4 2 3	1 5 3	2 0 0	7 8 2	6 17 1	2 14 1	1 8 2	11 0 0
do.	2	10 8 2	2 0 0	0 11 2	13 0 0	13 11 2	2 4 1	0 8 2	16 4 1
do.	3	10 7 0	2 0 0	0 11 0	12 18 0	9 7 0	2 17 0	0 4 0	12 8 0
Cork	1	1 12 3	0 14 1	1 1 1	3 8 1	2 10 0	0 12 2	0 17 1	3 19 3
do.	2	4 7 0	0 11 2	3 19 1	8 17 3	10 10 2	2 9 3	0 2 3	13 3 0
do.	3	6 0 0	0 10 0	0 0 0	6 10 0	5 15 0	1 2 2	0 0 0	6 17 2
do.	4	14 5 0	1 2 0	1 2 0	16 9 0	13 10 0	1 10 0	0 0 0	15 0 0
do.	5	9 10 0	0 17 2	0 2 2	10 10 0	7 3 0	1 8 0	0 0 0	8 11 0
do.	6	3 17 1	0 15 0	3 14 1	8 6 2	4 18 2	2 10 0	2 1 2	9 10 0
Donegal	1	9 4 0	0 2 3	0 11 2	9 18 1	12 5 3	0 5 3	0 4 1	12 15 3
do.	2	6 10 0	0 2 3	1 8 2	8 1 1	13 4 1	0 7 1	0 8 2	14 0 0
do.	3	10 15 3	0 5 3	0 12 3	11 14 1	15 4 1	0 6 2	0 7 1	15 18 0
do.	4	10 12 3	0 4 1	0 14 1	11 11 1	14 18 2	0 14 1	0 5 3	15 18 2
Dublin	1	8 0 0	1 11 2	0 13 0	10 4 2	7 7 0	2 15 3	0 3 0	10 5 3
do.	2	5 11 2	3 0 0	1 0 2	9 12 0	4 18 0	3 14 0	0 2 0	8 14 0
do.	3	7 0 0	0 7 1	2 12 0	9 19 1	8 5 3	1 10 1	1 18 2	11 14 2
do.	4	9 1 0	0 10 1	0 2 1	9 13 2	7 16 0	2 15 1	0 1 1	10 12 2
Galway	1	12 2 3	0 5 3	0 5 3	12 14 1	11 0 1	0 11 2	0 0 3	11 12 2
do.	2	8 18 0	0 7 0	0 18 0	10 3 0	11 1 0	1 10 0	0 4 0	12 15 0
do.	3	8 17 0	0 6 0	0 17 0	10 0 0	10 2 0	1 2 0	0 0 0	11 4 0
do.	4	4 13 3	0 8 2	1 11 2	6 13 3	6 1 2	1 17 1	0 1 2	8 0 1
Kerry	1	7 3 0	1 2 0	0 6 0	8 11 0	7 6 0	1 3 0	0 0 0	8 9 0
do.	2	9 10 0	1 12 0	0 12 0	11 14 3	9 14 0	1 11 0	0 0 0	11 5 0
do.	3	9 1 0	0 12 0	0 17 3	10 10 3	10 3 0	1 14 0	0 3 0	12 0 0
Kildare	1	3 12 0	2 10 0	0 3 0	6 5 0	2 1 0	2 17 0	0 2 0	5 0 0
do.	2	10 14 0	2 1 0	0 6 0	13 1 0	11 8 0	2 11 0	0 6 0	14 5 0
do.	3	10 10 0	0 12 2	2 6 2	13 9 0	11 4 3	1 16 1	1 3 3	14 4 3
do.	4	7 8 2	0 18 2	2 1 0	10 8 0	8 15 1	1 17 3	1 1 2	11 14 2
Kilkenny	—	5 14 0	0 12 2	1 2 0	7 8 2	4 16 1	0 11 2	1 8 3	6 16 2
Laoighis	1	7 17 1	2 15 0	1 17 0	12 9 1	8 4 3	1 14 1	0 16 3	10 15 3
do.	2	11 8 1	0 7 2	2 13 0	14 8 3	12 14 3	2 2 2	0 8 0	15 5 1
do.	3	6 1 3	0 8 2	2 17 2	9 7 3	5 4 1	3 2 1	0 7 3	8 14 1
Limerick	—	14 5 0	3 10 0	1 3 0	18 18 0	7 6 0	1 15 0	1 15 0	10 16 0
Longford	1	5 0 0	0 3 0	4 15 0	9 18 0	11 10 0	1 10 0	1 10 0	14 10 0
do.	2	2 12 0	0 3 0	5 8 0	17 18 0	8 0 0	2 0 0	0 8 0	10 8 0
Louth	—	14 3 1	0 6 3	0 1 3	14 11 3	13 3 1	0 1 2	0 3 0	15 7 3
Mayo	—	11 12 0	0 16 0	0 0 0	12 8 0	7 4 0	2 5 0	0 0 0	9 9 0
Meath	1	6 5 0	1 5 0	0 18 0	8 8 0	8 3 0	1 8 0	1 2 0	10 13 0
do.	2	8 5 0	1 10 0	1 15 0	11 10 0	12 3 0	1 12 0	0 1 1	13 16 1
Monaghan	1	4 5 2	0 2 0	2 9 0	6 16 2	7 17 2	0 8 0	0 13 0	8 18 2
do.	2	7 1 1	0 4 1	0 2 3	7 8 1	9 0 0	1 3 1	0 8 2	10 11 3
Offaly	1	11 1 0	1 17 0	0 1 0	12 19 0	7 1 0	6 2 0	0 2 0	13 5 0
do.	2	3 16 0	0 10 0	0 9 0	4 15 0	9 11 0	2 10 0	0 0 0	12 1 0
do.	3	6 15 2	0 13 2	0 13 0	8 2 0	11 8 2	3 8 0	0 0 0	14 16 2
Roscommon	1	6 12 0	0 11 0	4 0 2	11 3 2	12 3 1	1 2 1	0 4 2	13 10 0
do.	2	4 10 3	0 2 0	3 13 2	8 6 1	12 2 2	1 1 0	0 2 3	13 6 1
do.	3	5 0 0	0 10 0	0 11 0	6 1 0	7 15 0	0 17 2	0 4 0	8 16 2
Sligo	1	12 2 0	1 8 0	2 7 0	15 17 0	17 4 0	3 17 0	0 6 0	21 7 0
do.	2	8 12 0	0 10 0	4 6 0	13 8 0	10 0 0	1 3 0	1 3 0	12 6 0
do.	3	11 12 0	0 18 0	1 2 0	13 12 0	10 18 0	0 15 0	0 3 0	11 16 0
do.	4	17 11 0	1 9 0	0 5 0	19 5 0	17 3 0	2 12 0	0 2 0	19 17 0
Tipperary N.R. ..	1	7 12 0	0 12 0	3 17 0	12 1 0	11 8 0	3 15 0	0 12 0	15 15 0
do.	2	8 11 1	0 15 2	4 4 1	13 11 0	6 8 1	1 6 1	1 2 1	8 16 3
Tipperary S.R. ..	—	16 10 0	1 5 0	0 5 0	18 0 0	14 0 0	2 0 0	0 10 0	16 10 0
Waterford	—	6 0 0	0 14 0	5 14 0	12 8 0	6 18 0	1 5 0	4 9 0	12 12 0
Westmeath	1	10 12 0	1 1 0	0 3 0	11 16 0	10 5 0	2 6 0	0 2 0	12 13 0
do.	2	11 8 0	0 14 0	2 12 0	14 14 0	15 14 0	1 14 0	0 18 0	18 6 0
*Wexford	1	8 10 0	0 11 2	4 9 0	13 10 2	13 0 0	1 8 0	0 15 3	15 3 3
do.	2	5 2 0	0 8 2	—	5 10 2	4 11 2	0 5 0	—	4 16 2
do.	3	7 9 0	1 16 0	—	9 5 0	10 13 0	1 2 0	—	11 15 0
Wicklow	1	12 9 2	0 10 2	0 1 2	13 1 2	9 12 0	1 6 2	1 1 0	11 19 2
do.	2	11 16 0	0 15 2	0 2 1	12 13 3	9 5 2	1 7 2	0 5 1	10 18 1
do.	3	13 0 0	0 0 0	0 15 0	13 15 0	9 10 0	1 0 0	0 10 0	11 0 0
do.	4	14 10 0	0 10 0	0 10 0	15 10 0	9 0 0	0 10 0	0 10 0	10 0 0
Average (68 centres)		8 9 0	0 17 3	1 10 1	10 17 0	9 15 1	1 14 3	0 10 2	12 0 2

*Yield of small and diseased tubers at centres 2 and 3 given together in column headed "small."

THE SHOEING OF HORSES FOR TRAFFIC ON MODERN ROADS.

Considerable change has taken place in the last twenty years in methods of road construction. Formerly steam-rolled water-bound macadam was in general use on important roads and was found to give service and to provide a satisfactory surface for many years so long as the traffic was not unduly heavy or fast. As motor traffic increased, however, and particularly as heavy trucks were introduced this form of surface was found to be unsatisfactory, pot-holes formed rapidly, a dust nuisance was created and the frequent renewal of the surface which became necessary was very costly. For the benefit of the public and the comfort of those using the road, improved methods of construction were adopted. The camber of roads generally has been reduced and roads are now produced that are waterproof, dust-free and that retain a good surface for a comparatively long time. In general, the new surfaces are harder and smoother than the old and are much better for vehicular traffic of all kinds; they are also quite satisfactory for horse traffic provided that horses are properly shod. When the latter condition is not observed, however, the hardness and smoothness of the modern road shows up shoeing defects which might have remained unnoticed while the animal travelled over the old water-bound macadam road, rough enough in all weathers to prevent slipping.

Calkins on shoes should be avoided as far as possible because they are contrary to the principles of shoeing, preventing absolutely complete functioning of the frog and interfering with the normal slope of the hoof and consequently with the proper distribution of the weight on the foot. They are frequently used unnecessarily, for their only function is to give a grip especially in the case of draught horses pulling heavy loads on paved streets and when going down hill. It is generally sufficient to have them only on hind shoes. They should not be higher than twice the depth of the shoe and should have sufficient substance to wear as long as the latter. Heavy cart horses are sometimes shod with flat shoes in front and behind and do their work satisfactorily. The transition from calkins to flat shoes must be made cautiously, as a sudden change may cause injury and pain. The change may, however, be usually made with safety when the calkins are practically worn to a level with the shoe and the horse is being re-shod, provided special attention be given to maintaining the existing position of the horse's feet and limbs in relation to the ground.

The shoeing of a horse is an operation demanding not only highly skilled craftsmanship, but exact knowledge of the anatomy of the horse's foot; in particular it calls for an understanding of the function and use of the frog.

This corrugated horny portion of the hoof must touch the ground and have exercise in order that the health of the foot may be preserved. Its shape is such that under pressure it presses in and out the back portion of the hoof, which action in turn keeps the cartilages and glands inside in their natural healthy condition and secures for the complicated foot joint the necessary lubrication and mobility. Further the texture of the frog is such that it will not easily slip even on a smooth surface ; it is highly elastic and offers a natural pad to bear and distribute pressure and lessen concussion. When through ignorance this pad is cut away and not allowed to touch the ground the frog withers, the hoof contracts, diseases of the foot develop, the horse becomes lame, suffers pain and loses value.

The horse should be shod so that the frog will bear on the ground and grow and develop with use, that is, the shoes should be flat, but should only be fitted round the interior and lateral margins of the hoof, the heel region being uncovered. When this method of shoeing is adopted on a suitably prepared hoof, the frog will come on the ground and all the advantages of frog pressure will be obtained including shock absorption, expansion of the posterior region of the hoof and the prevention of slipping on smooth surfaces.

In preparing the hoof for this type of shoe the wall of the heels is not reduced, the aim being to have the bearing surface of this portion of the wall as nearly as possible on a level with the ground surface of the shoe. If the hoof is not sufficiently strong to tolerate this method of shoeing, short shoes with bar pads or flat shoes with other pads should be used. They afford a grip and permit of frog pressure.

The foregoing method of shoeing working horses has been proved by some of Dublin's best known farriers to be entirely satisfactory and has been adopted by them in shoeing horses owned by many large commercial firms. Experience has shown that the non-protected part of the wall withstands the wear for the duration of the shoe and that the frog remains plump and well developed, bearing weight and performing all its functions. This method is particularly appropriate for modern smooth surfaced roads. For ice-covered roads frost nails are indicated.

The next best method of shoeing is by means of flat shoes of sufficient substance to withstand wear for about three or four weeks. With this method however, and using the ordinary shoe, the frog will not function completely, being raised from the ground by the thickness of the iron.

(Issued as Special Leaflet No. 26, October, 1943).

ON PLANTING TREES ON THE FARM TO PRODUCE POLES AND TIMBER.

On most farms there is usually an area of ground which is not suitable for normal farming or provides only rough grazing either because it is not easy of access or is rough or rocky or suffers from wet surface conditions. An area of this kind may be quite suitable for growing trees for the production of poles and timber. This is a somewhat different proposition from the planting of trees for shelter belt and hedgerow which is dealt with in Leaflet No. 70 and differs also from the subject matter of Leaflet No. 65 which is concerned with the planting of waste land from the point of view of the suitability of the various tree species to the different local conditions. The latter leaflet contains notes on planting-distance ; type of plant to use ; season of planting and protection of plantations and it should be consulted in all cases before commencing any tree planting scheme.

Suitability of tree to site must always be the first consideration in planting. Leaflet No. 66 describes methods of planting the trees on the ground. The present leaflet is concerned rather with the choice, where there is any room for choice, of trees suitable for purely utilitarian purposes on or about the farm or for sale to timber merchants and others interested in the conversion of timber. The advantage to the farmer of being able to secure, when necessary, from his own woods, occasional trees for fencing material, for repairs to buildings, implements, etc., is obvious, while the provision of firewood is likely to be a more important consideration than hitherto.

CHOICE OF SPECIES.

Where rapidity of production is the aim and the farmer wishes to get an early return for his outlay, coniferous species are to be preferred, especially when the smaller poles which have to be removed in the early thinnings can be utilised. Such species are *European* and *Japanese Larch* and *Norway* and *Sitka Spruces*. Amongst the broad-leaved trees,* however, *Ash* and *Alder* are two species which are also rapid growers and are capable of providing small poles for fencing purposes and general use about the farm at comparatively early ages. Generally speaking, all these species require soils of at least moderate fertility. *Larches* should not be planted on ground which is heavy, impermeable and difficult to drain. The Japanese species produces a less durable

* The term "broad-leaved" is applied to trees with flat leaves, such as those of the Oak or Beech, and is used to distinguish them from conifers, most of which have needle-shaped or narrow leaves.

timber but is to be preferred on more exposed sites and on less fertile ground where it grows more rapidly and vigorously than the European species. Larch plantations are usually ready for first thinning from twelve years onwards and produce useful material throughout their life in the form of small stakes and rustic fencing material and, later, larger stakes, strainers, pitwood and stackyard poles and ultimately constructional timber, especially suitable for the making of carts, etc.

Spruces,* being shallow rooters, are capable of thriving on the heavier, less permeable and less well-drained soils. In respect of timber and capacity to resist exposure and to put up with infertility in the soil, Sitka Spruce bears the same relation to Norway Spruce as Japanese Larch does to European Larch. Spruce plantations are not usually capable of surviving to maturity when planted in small pure blocks, expecially when the light and wind gain access on the margins of the plantations. They should therefore usually be surrounded by belts of other species. The rate of production, especially of Norway Spruce, is slower than in the case of Larch and plantations are ready for a first thinning from fifteen years onwards in the case of Sitka Spruce and twenty years onwards in the case of Norway Spruce. The first thinnings of these species are less durable than Larch but are straighter and furnish when quite small useful material for pea stakes and fencing rails. Later thinnings will provide poles for stack-yard purposes and scaffolding and the mature trees furnish excellent box-making timber and building timber.

Ash is a tree which requires high soil fertility aud a constant moisture supply in the soil but it is a common tree in this country, especially in limestone areas. It can be grown pure where there is no risk of frost damage, and it stands exposure well. The timber is not very durable but its strength and elasticity make it suitable for certain purposes. Small poles provide fencing rails and tool handles. Larger poles are suitable for oars, weir-poles, sports goods and for the manufacture of implements. Well-grown Ash always finds a ready sale and the tree also produces good fuel.

Black Alder is valuable on account of its ability to grow on water-logged swampy ground which is not too infertile. It is easily grown and when it is cut back after twenty years of age will throw up a new growth of vigorous stool shoots, providing useful small poles for temporary repairs to fences. The larger poles are suitable for turnery work or brush making, clog making, etc., but there is not a high demand for such materials at the present time.

Other species well worth growing, although they do not produce utilisable material so soon after planting, are Scots Pine and *Thuya plicata* amongst the conifers, and Beech, Grey Poplar and Black Italian Poplar amongst the leaf trees.

Scots Pine is one of the safest trees to plant especially on more infertile sites,

including well-drained peat, where, although growth may be slow, it ultimately produces valuable timber which is specially suitable for constructional purposes, transmission and other poles, box-making and, in the larger sizes, for railway sleepers. The smaller thinnings in respect of utility resemble those of Spruce. *Thuya plicata* is a useful tree for shallow limestone and other fertile soils where it can be grown pure in small groups or plots. It furnishes very durable fencing material but is not suitable for growth to larger sizes on the farm. This tree and also *Lawson's Cypress* make very useful edgings on suitable soils for Spruce plantations.

Beech, although relatively slow-growing, is well suited for limestone and other fertile soils. It is wind-resistant and able to remain healthy even when grown in small clumps. The tree is of value for the making of packing cases and butter boxes and it provides a satisfactory fuel wood.

Poplars are fast-growing trees but, with the exception of the Aspen and Grey Poplar, they must have a constant and very liberal supply of fresh soil moisture. *Black Italian Poplar* should therefore be confined to alluvial soils on the sides of water courses or around perennial springs. It is easily grown from cuttings and produces timber of large size fairly rapidly, suitable for flooring, box-making and match-making. *Grey Poplar*, the uses of which are similar, can be grown on drier sites especially on limestone and limestone gravel and silt soils. Individual Poplar trees require ample room, especially for root development.

In addition to the trees dealt with above, the growing of occasional Oak, Spanish Chestnut, Elm, Sycamore and Lime can be recommended under suitable conditions as trees capable of producing timber, though not rapidly, for special purposes, for which, however, there is only a small demand. Thus Oak is used for special constructional work about the farm and for making wheels, carts, gates, etc. ; Elm for wheel and cart-making ; Elm and Spanish Chestnut for coffin boards ; Sycamore for turnery work and Lime for turnery, brush-making, match-making, etc.

MIXTURES OF SPECIES.

By mixing two or more species, the farmer might achieve several objects, *e.g.*, early production of small useful poles combined with later production of more valuable timber and the production of frost-tender species in early youth in the shelter of more frost-hardy trees. Mixed woods require more careful personal attention than pure woods and it is possible to give this in the relatively small plantations on the farm. In wet, low-lying ground suitable mixtures are Alder/Ash or Alder/Spruce, the Alder acting as nurse. Poplar may be used to replace or supplement the Alder in these mixtures. On drier, fertile soils Eurpoean Larch is an excellent nurse for most leaf-trees, especially Beech, Oak, Spanish Chestnut. Japanese Larch is less satisfactory owing to its more rapid and vigorous growth. Scots Pine is also a good nurse on less

fertile sites for Oak and Beech and on boggy ground for Spruce. On heavy soils some Oak may be mixed with Spruce and on drier limestone soils, Grey Poplar and Scots Pine are suitable nurses for Ash and Beech. It is not advisable to have too elaborate a mixture of species.

Brashing and Pruning.

For three to five years after planting, care should be taken to free the small plants from luxuriant grass and other vegetation which may damage them, and all failures should be replaced. No further attention is necessary until canopy has been formed ; *i.e.*, until the side branches of the individual trees have met and, by shading out the light, killed off the ground vegetation and all the lower branches. This happens at ages varying from ten to twenty years according to the rate of growth and species. It is now necessary to enter the plantation in order to remove the dead lower branches. With Larches this can easily be done with a club or the back of an axe or billhook but with broad-leaved trees and other conifers, these branches should be sawn off with a small hand-saw, flush with the stem. Broad-leaved trees require individual attention and should be carefully pruned, especially when they fork, in order to encourage straight growth. It is not usually advisable to prune the outer branches on the margins of the plantation. When this operation is completed it becomes possible to walk through the plantation under the canopy.

Thinning Operations.

The plantations require further attention from now on to maturity. This tending consists in the removal of a greater or smaller proportion of stems from time to time. The underlying principle in this is to remove inferior stems in order to leave room for better stems—or better species in mixtures—to develop. Usually these will be the smaller trees but it is often more important to take a small number of the larger, coarse, forked and crooked trees. The thinnings removed form a useful source of small material and later on of revenue. The thinnings should never be so heavy as to form a permanent gap in the canopy nor should they be so light as to compel the trees to develop into drawn-out weak stems with insufficient foliage. Care should be taken in felling and removing the thinnings not to damage the rest of the crop.

Protection and Maintenance of the Stand.

It is desirable at all times to prevent the growth of grass and strong vegetation in a woodland and this is best done by keeping the canopy close and on no account should stock be allowed into the stand to graze or to shelter. In most cases, especially on fertile ground, careful attention to this and to the gradual thinning of the stand will sometimes result in natural seeding which should be encouraged.

Disposal of Mature Timber. Extraction. Method of Sale.

Where thinnings and mature timber are in excess of the owner's requirements they may be disposed of either by local auction sale, standing or felled,

by sealed tender or by private treaty. It is eminently desirable from every point of view to encourage fair competition in these sales. In thinnings, etc., it is usually desirable that the owner should fell the trees himself or with his own staff and the thinnings are best sold by public auction in lots of 12, 24, etc. Firewood trees may usually be sold standing. Larger lost of valuable trees should be marked individually and listed and offered for sale publicly by species and numbers of trees. There should be a proper sale agreement with a time limit for removal and clauses ensuring compensation for damage, etc., and defining the passages over which the material is to be extracted. The provision of satisfactory extraction roads to plantations is an important consideration.

Where trees are planted for the production of timber and other materials and not for ornament or shelter a planting grant amounting in all to £10 per acre may be paid by the State through the Forestry Division of the Department of Lands. Payment of the grant is made in two instalments, one of £5 immediately after planting and the second of £5 five years after the establishment of the plantation and is subject to certain conditions as to protection and maintenance. The minimum area for which a grant is payable is one acre. Particulars may be obtained from The Secretary, Forestry Division, Department of Lands, 89 Merrion Square, Dublin.

THE POTATO CROP.

Broadcast Talk given by DENIS DELANEY, B.Sc., A.R.C.Sc.I., Inspector Department of Agriculture, on 24th February, 1944.

The potato planting season is again at hand and farmers must soon decide on the area and varieties for next season's crop. Appeals are being made on all sides to increase the area under potatoes as it is quite evident that in the absence of other feeding stuffs the present acreage is not sufficient to maintain our agricultural output at anything like normal levels.

Although in recent years about three quarters of the potato crop was consumed by stock on the farm a large proportion of our output of livestock and livestock products depended largely on imported and other feeding stuffs. Now, however, when these feeding stuffs are no longer available there is a serious falling off in the supply of such important commodities as butter, bacon and eggs and dwellers in the industrial centres have from time to time experienced some difficulty securing supplies of potatoes for domestic use.

Such a state of affairs is indeed disappointing and if allowed to continue can only result in further reductions in output followed by loss of export markets finally leading to stagnation and national loss. Increased food production is a great national necessity and in this connection the potato crop holds pride of place as the producer of the greatest amount of food per acre for both man and beast. In 1943 the area under potatoes was 407,000 acres, a reduction of approximately 18,000 acres on the 1942 crop. Fortunately the yield was satisfactory in northern and midland counties but in some southern areas blight affected the yield to such an extent that supplies are barely sufficient to meet current local needs. It may sound absurd to talk about a scarcity of potatoes but yet it could become a reality. Is it realised however that there is a much greater risk of a bad wheat harvest or that those precious cargoes which have to fight their way across the dangerous seas, may be unable to come safely into port?

To provide against such contingencies a substantial increase is necessary in the area under potatoes during the coming year. One hundred and fifty thousand to two hundred thousand acres extra should present no great difficulty if the majority of land holders would each grow an extra ½ acre or an acre. Apart from the question of allotments there is also room for enterprising city firms, including merchants actually engaged in the potato trade to acquire land for potato growing and other food production.

This work has already been undertaken by a few firms and might be extended if only to provide sufficient potatoes to meet their own household needs and those of their employees. Employees might, in turn, reserve holidays for planting and lifting of the crop and thus perhaps gain some experience of the problems with which farmers have to contend.

With regard to potato yields the most successful growers make no secret of their methods. These are, early ploughing, good cultivation and manuring, careful selection and sprouting of seed, thorough spraying and intelligent use of the knowledge and equipment available both in the production and final disposal of the crop. No doubt soil and season play an important part and while the weather cannot be controlled, the skilled farmer can do much to adjust time and methods of cultivation to ensure suitable soil conditions for the satisfactory growth of the crop and thus influence yield to a large extent.

We are fortunate in that good yields have been produced with very limited equipment but in the case of manures we are not quite so fortunate. It is practically impossible to procure suitable fertilisers and we are therefore compelled to depend almost entirely on farmyard manure.

Any good system of tillage requires a plentiful supply of manure for application to such crops as potatoes and roots, and to-day this applies particularly to the potato crop. An extra dressing of 5 tons per acre of well made farmyard manure will go far to replace the standard dressing of artificials usually applied to the potato crop.

On some farms there are now surplus supplies of straw which could be used more liberally to make manure in the bedding of stock in houses, open yards and certain gateways. Steps should also be taken to ensure that all liquid manure is fully absorbed in the manure heap. This liquid is rich in potash which is so valuable in the manuring of the potato crop.

Bearing on this question of manures, it has been observed that some potato crops—especially the variety Kerr's Pink—have shown a withered, brownish appearance of the foliage early in the season. This has caused a premature ripening of the crop, resulting in a poor yield with a rather large proportion of small tubers. As the brown appearance of the foliage has coincided with the spraying period farmers have attributed the condition either to blight or injury caused by the spraying material. A dry spell of weather also aggravates this unhealthy condition which is not due to any specific disease, but in most cases, is the result of insufficient or incomplete manuring. The best means, therefore, of preventing it is a more liberal dressing of farmyard manure or seaweed or, if obtainable, dressings of fertilisers containing some potash.

Good manuring and good tillage will not, however, produce satisfactory returns in the absence of good seed. Outside the recognised seed growing

areas many farmers are needlessly careless in the selection of suitable seeds The planting of diseased, worn-out varieties can only result in reduced yield, consisting of a large proportion of rough unsaleable potatoes. It will be found also that many of these tubers are very hard to cut. perhaps deeper in the eyes than usual and if again planted as seed will produce rough bolter-like stalks. These stalks continue growing late into the season and may have a good show of flowers, with the result that digging has to be delayed and there is a greater risk of disease, especially blight. Altogether the results from such seed are very disappointing.

Successful growers change their seed at regular intervals and plant only certified seed or the produce of a crop which was certified the previous year. It is a good plan to buy in a small quantity of certified seed every second year and have it grown in isolation. The produce will be sufficient to provide healthy seed for planting the entire crop the following season. Growers are reminded that in changing seed the type of soil on which it was grown is not nearly as important as the fact that the seed is the produce of a healthy crop. Many still judge seed on its appearance in a bag as found in the market place. We should remember that no matter how well the seed is graded or attractive it may appear it is a waste of money to buy it unless it is the produce of a healthy crop free from virus disease. Inspection in the field during the growing season is the only means of telling whether the crop is healthy or not. Certified seed with its red seal on the bag is, however, a reliable guarantee of health. With regard to certified seed, complaints are sometimes received about its size or grading. The size ranges in diameter from $1\frac{1}{4}''$ to about $2\frac{1}{2}''$ depending on the variety, and is branded on the bags $1\frac{1}{4}''$ x $2\frac{1}{2}''$. As tubers of $1\frac{1}{4}''$ in diameter look rather small there may be disappointment unless the size of seed required is clearly stated when orders are being placed. Sometimes the size of seed is indicated on the bags by the letters S and W which signify "seed" and "ware." Here you get extremely small to very large tubers which may also be the subject of complaint unless the purchaser understands that he is buying a cheaper article because of the fact that it is not graded uniformly. Varieties of potatoes are so numerous that farmers often find difficulty in deciding which to plant. Choice usually depends on the purpose for which the crop is grown, *i.e.*, whether for consumption on the farm, or for sale as seed or ware, or again, whether for export or home trade. In present circumstances the old reliable varieties, Epicure, British Queen, Kerr's Pink and Arran Banner can be safely recommended for home requirements. Arran Peak, Gladstone, Up-to-date and Arran Consul are useful for both home and export trade. A limited quantity of other first and second earlies are also needed and include such varieties as Arran Pilot, Nintyfold, May Queen, Duke of York, Sharpes Express, Eclipse, and Great Scott. The varieties May Queen, Duke of York and Sharpes Express are the most suitable for home use.

Some of the newer varieties are Doon Eire (Eireann), Ulster Chieftain and Dunbar Rover. Doon Eire is a main crop variety which won the Lord Derby

gold medal recently and is now grown by a group of farmers in Donegal. This is an immune variety which should be suitable for the export trade. Its tubers are, however, rather susceptible to blight and hence the crop requires very thorough spraying. Ulster Chieftain is a new first early variety bred by Mr. John Clarke, Ballycastle, Co. Tyrone. As an first early the table quality is good. Stocks, so far available, are not sufficient for distribution to merchants. The variety Dunbar Rover is now fairly well known. It is a second early of good table quality, has given good results on the dryer types of soils, but will miss badly if unsprouted tubers are cut for seed purposes. In city gardens where attempts have been made to grow Kerr's Pink the variety Dunbar Rover might be given a trial.

One advantage of growing earlies or second earlies in small city gardens is that they can be dug out by early September at a time when slug injury becomes serious. In such surroundings Maincrop varieties like Kerr's Pink are often rendered useless as they cannot be dug until about October by which time they are badly damaged by slugs.

The practice of sprouting seed cannot be too strongly recommended. On many farms it is, however, difficult to provide suitable accommodation for sprouting boxes or even a suitable loft or barn floor where the seed might be spread out thinly. On some small farms in Northern and Western counties the following simple, though perhaps risky method of sprouting potatoes is adopted. The selected seed is placed on dry ground on the sheltered or sunny side of a fence or wall convenient to the dwellinghouse and covered with drawn straw. Straw may also be placed under the seed. The most reliable member of the household keeps the seed under observation from day to day and the covering of straw is varied according to weather conditions. Obviously such a system must not be adopted too early in the season because of the risk of damage by frost.

One of the advantages of using sprouted seed is the fact that you get a uniform crop and there are very few misses or blanks. If seed has to be cut the risk of blanks is not nearly so great if it has been even slightly sprouted before cutting. On the other hand many unsprouted varieties are almost certain to miss if cut and planted under very dry weather conditions. Trials carried out in connection with the treatment of unsprouted cut seed, prior to planting have shown that :

(1) Best results are obtained if the seed is planted immediately after cutting.

(2) If cut seed cannot be planted immediately it is advisable to store it in a dark, damp atmosphere such as might be obtained by covering it with clean, damp sacking.

on a healthy leaf it germinates if conditions are favourable and produces about eight smaller spores each of which can cause infection. A few days after the leaf becomes diseased it in turn bears a new crop of spores which are carried about to infect other healthy leaves, and so the disease spreads.

During periods of heavy rain large numbers of blight spores are washed from the diseased leaves on to the soil. These spores may also be a source of danger, as they may infect potatoes that are not well covered with soil producing what is generally called "blackening of the potato." How many growers have seen large portions of their potato crops made valueless because of this blackening and have not connected it with potato blight ? The disease is, however, easy to identify as the affected tubers show slightly sunken dark brown irregular patches on the outside. These patches, when pressed with the finger, are quite hard. If such a potato is cut through it will be seen that the flesh to the depth of a quarter to half an inch inside the patches has turned brown.

Such blighted or blackened tubers form an almost useless part of the crop due to their diseased condition but they may also be a very serious danger in another way. They bear the spawn of the blight fungus within them and if they get a chance of growing the following season the fungus may grow from the tuber into the stems and eventually into the leaves which become diseased. Such diseased leaves will then bear numerous spores of the fungus which may be carried about to healthy plants and so the blight outbreak starts.

It is easy to see, therefore, that in order to reduce the possibility of a blight outbreak such diseased tubers should not be used as seed. Even when potato seed is cut before planting there is always the danger that blighted tubers may be planted accidentally and a very careful watch should be kept so as to avoid this possibility. Here the grower who has his seed potatoes in sprouting boxes has the advantage. He can examine them with ease and so remove any diseased tubers which show themselves during the sprouting period. The practice of discarding blighted tubers on to sides of the potato pit, or of allowing them to remain in the field or of throwing them on to the manure heap cannot be condemned too strongly. Very often potato blight is found to start from diseased plants growing from infected tubers in these situations. Consequently, I do not need to say that all blighted tubers should be destroyed preferably by cooking for stock feeding or by burning. Such a precaution might result in the delay of a couple of weeks in the appearance of blight in a potato field and so make all the difference between profit and loss to the grower.

It would be too much to expect that outbreaks of blight could be eliminated altogether and so it is desirable that the potato crops be afforded all available protection before the outbreak does commence. Most potato growers

are aware that the disease can be prevented or at least kept in check by the application of a spray to the foliage. In order, however, that the spray should be effective, certain conditions must be fulfilled. First of all the spray used must be capable of killing the blight spores when they alight on the sprayed potato leaves. Secondly, it must be capable of sticking to the leaves and must not be easily washed off. Thirdly, it must be applied in such a manner as to ensure that the upper and lower surfaces of all the leaves in the sprayed crop are evenly covered with the spray and lastly, but by no means the least important, a sufficient number of sprayings should be given at intervals of three weeks so that all new foliage formed after the previous spraying will also be protected against infection. As regards the spray to use, experience has shown that in seasons of severe blight outbreaks Burgundy mixture of two per cent. strength gives the best control. Such a mixture is composed of 8 lb. of Copper Sulphate or Bluestone, 10 lb. of washing soda and 40 gallons of water. Another spray used in some parts of the country is composed of copper sulphate, lime and water and is called Bordeaux mixture. This is probably as effective in keeping potato blight in check as is Burgundy, but it has certain disadvantages. The most serious of these disadvantages is that it frequently causes choking of the nozzles of spraying machines due to the presence of gritty particles in the mixture. On this account Burgundy mixture is preferred. Directions for the preparation of both Burgundy and Bordeaux mixtures are given in Leaflet Number 14 of the Department of Agriculture and I would strongly urge every potato grower to obtain a copy of this leaflet and to read it carefully.

There are, however, a few points I would like to emphasise in connection with the preparation of these spraying mixtures. It is very important that the dry constituents of the spray should not be mixed together before being dissolved in the water. If this is done, a very poor spray results, which is difficult to apply and which does not stick well to the leaves. The best results are got when the substances are well diluted before mixing. The common practice amongst farmers in preparing a Burgundy mixture is to dissolve the 8 lb. of copper sulphate in about 38 gallons of water in a forty-gallon barrel. The 10 lb. of washing soda are then dissolved in about two gallons or less of hot water and are added to the copper sulphate solution. The addition of hot washing soda solution to the copper sulphate is a bad practice as it results in an inferior spray. The washing soda solution should be well cooled by the addition to it of cold water, always ensuring that the total of the two solutions does not exceed forty gallons. Vigorous stirring of the mixture while the solutions are being added to each other is also essential if the best results are to be achieved. Having obtained a good spray by these precautions it is important that it be used while fresh, as if left standing for any length of time its efficiency as a blight preventative becomes very much reduced. In addition to Burgundy and Bordeaux Mixtures as blight preventatives, there are also proprietary sprays, some of which have given satisfactory results in controlling potato blight. Most of these sprays have the advantage that they

are easy to prepare, requiring only to be stirred up in a certain quantity of water. They are, therefore, particularly attractive to potato growers like the gardener or allotment holder. I would advise any such growers who refrain from spraying on account of the trouble involved in preparing small quantities of Burgundy Mixture to use one of the proprietary sprays prepared by a reputable firm.

As regards the time to spray, it is difficult to make a hard and fast rule, as a good deal will depend on the weather and also on the locality. Generally speaking, it is usually necessary to spray earlier in the South and West than it is in the midlands or eastern counties as the rainfall is generally somewhat heavier in the former districts, especially in the coastal regions. If at all possible however, the first spray should be given before the disease appears, say about mid-June, the second about three weeks later and a third about a month after that. The grower, however, will have to be guided to a large extent by the weather conditions prevailing at the time. It frequently happens that a severe outbreak of blight does not develop until well on in the growing season, say about mid-August so that the third spray which would be applied early in August is often the most important.

In applying the spray it is essential to see that the upper and lower surfaces of all the leaves are covered. The amount to apply will depend, of course, on the amount of foliage in the crop. For the first spray eighty to one hundred gallons per statute acre are generally sufficient as this spray is generally given before the crop is in full foliage. Once this stage is reached, however, about one hundred and twenty to one hundred and forty gallons per statute acre are required. It is better to err on the side of a heavy application than to stint the amount of spray. Growers who hire others to spray their crops should see that the spray is effectively applied. There is sometimes a tendency to rush the job and carry it out in a slipshod manner. Spraying machines also should be kept in good order. Those with worn pumps, leaking connections or damaged nozzles are quite incapable of working efficiently and it is often a waste of time and spraying material to use them.

Spraying the crop will control the disease on the foliage and by so doing will, of course, reduce the risk to the tubers. Extra protection can, however, be afforded these in another way. Careful earthing or moulding of the plants will prevent spores which are washed from the leaves from coming in contact with the tubers and causing them to become diseased. Many of my listeners will, no doubt, have noticed that it is the tubers near the surface of the soil or those that are exposed which show the blackening first.

Another way in which the tubers may be infected is by digging them while some of the blighted tops are still green. This operation scatters the blight spores on to the freshly dug potatoes and if these are then pitted or left in acks even for a short time the amount of disease which follows is generally

considerable. This method of infection often creates the impression that the disease has spread from tuber to tuber in the pits or sacks but this is not so. Diseased tops should be allowed to die down and the crop should not be dug except for immediate use, for at least a fortnight after the tops have died. By that time any spores which are in the soli will no longer be capable of causing infection.

It is sometimes necessary to dig potatoes, not required for immediate use. before the tops have died down. In such cases the foliage may be destroyed by a spray contaming about fifteen per cent. sulphuric acid, that is 15 gallons of Brown Oil of Vitriol usually referred to as "B.O.V." in 85 gallons of water. This spray rapidly kills potato foliage, weeds and blight spores on the foliage and in the soil. In preparing the solution it is very important to pour the acid into the water and not the water into the acid. Avoid getting the spray into cuts or into the eyes. A special machine is necessary for spraying with sulphuric acid as the acid tends to corrode the parts of the ordinary sprayer. This difficulty may be overcome by the use instead of sulphuric acid of a 5 per cent. solution of copper sulphate, that is 20lbs. of copper sulphate in 40 gallons of water. This spray is not usually as efficient or as rapid in action as is sulphuric acid. Spraying to kill potato foliage and blight spores as I have just described is also useful in reducing losses where a severe outbreak of blight is threatened late in the season. In fact, this operation in combination with the ordinary spraying during the growing season would go far to produce completely blight free crops. It is a bad practice when pitting potatoes to cover the tubers, even temporarily, with potato stalks that have been killed by blight as such stalks may carry blight spores. These spores may be shaken on to or washed down among the tubers causing them to become blighted.

Last season there were considerable losses of potatoes in certain districts due to blight, but it is a striking fact that no complaints of this nature were forthcoming where spraying was properly carried out. Let us hope that in the coming season every attention will be paid to reducing to the absolute minimum the losses caused by potato blight.

It is hoped that ample supplies of Copper Sulphate and Washing Soda will be available in the coming season.

OATS AND BARLEY.

Broadcast talk given by JOHN BROPHY, M.Agr.Sc., Department of Agriculture, on 16th March, 1944.

During recent times circumstances have gradually rendered it more and more necessary for us to become independent of imports of both human and animal foods. A big increase in crop production has already taken place, but to be convinced of the need for more food than is being produced even now, one need only reflect that wheat, bacon, milk and butter—to mention but a few outstanding commodities are required in much increased quantities to satisfy even the home demand for them. It is to the advantage of every farmer to have for sale now as much crop and stock produce as possible after providing for the needs of the household and the livestock remaining on the farm.

If the necessary output of animal products is to be achieved—in other words, if consumers are to have sufficient of these foods and if farmers are to profit by their production—the first essential is that a plentiful supply of foodstuffs be grown to feed the animals. Poorly-fed, low-producing farm stock can not be expected to be profitable and on many farms poor winter feeding of the stock lessens considerably the returns obtained. In order to enable the maximum head of stock to be kept and well fed the best course in present circumstances is to have a large proportion of the arable acreage of the farm under tillage crops. Tillage and livestock raising are not opposed to each other rather does the one support the other, more thrifty stock and more fertile soil resulting from their combination. This is, in fact the chief way in which greater total output can now be attained on the majority of Irish farms.

It will be appreciated that there are many good reasons why, now more than ever, the oat and barley crops should be extensively grown and why careful attention should be paid to every detail in their cultivation which may assist in securing the best possible yield. Except for limited quantities of milling offals, meat meal and beet pulp, oat and barley grain is almost the sole concentrated food avaliable for the feeding of farm stock. The utility of oats as a foodstuff is taken so much for granted as not always to be appreciated. Every farmer and horse-owner exploits its excellence as a horse food and what a handicap it is to the farmer's wife and poultry-keeper to be short of oats at any season of the year ! Without preparation other than to have it crushed and fed dry from a trough, oats provide all that is required in the way of meals with seperated milk in the rearing of calves. It generally forms the bulk

of the meal mixture fed to dairy cows, weanling calves, fattening cattle and sheep, and when ground to meal it can be used in appreciable quantity in the diet of fattening pigs. As a source of human food, also, oats merits greater respect. When available in sufficient quantity, oatmeal and milk should, at least in the case of growing persons, be used in place of part of the white bread and tea which have been consumed here to the extent of constituting a major defect in our dietary. Even now there exists at our farmers doors an unsatisfied demand for oats for the production of oatmeal. It is hoped that this demand will be met and that prejudice or want of knowledge of the nutritional values of these foods will not be an obstacle to their increased use.

In some districts, barley is not as highly valued as a stock food as it deserves to be. It is particularly suitable for pigs and poultry ; in fact no pig feeder can well afford to be without some barley. Better fattening rations for cattle and sheep also can be prepared by using a proportion of crushed barley with oats rather than use oats only as the main bulk of the meal mixture. The maize, formerly imported for these purposes, to the extent of three or four hundred thousand tons annually is not missed on farms where, for each ton of maize that was used, an acre of barley can be grown together with a patch of kale or other green food for winter use.

It is scarcely necessary to stress the dependence of our brewing and distilling industries on an adequate supply of barley of malting quality and the good market which these industries afford for such grain.

The oat and barley crops make relatively low demands on labour for their cultivation and the comparative ease with which the grain can be stored, with little loss of feeding value until the lean summer months, should commend them specially to pig and poultry feeders.

Oats is not particular as to soil type. In fact, farmers generally do not have to stop to think about the suitability or otherwise of their land to produce a satisfactory crop, apart from the precaution of using a variety suited to the district and the fertility of the soil and, perhaps, in occasional cases where the ground is very rich, to take a wheat crop immediately before the oats. Barley is somewhat more exacting in this respect. High quality malting grain is produced on the sharp, warm soils which occur chiefly in Leinster and parts of Munster and it is not possible by cultural means to produce such samples on soil inherently unsuitable for the purpose. Consequently, farmers in some districts have come to regard the barley crop as being of no concern to them. But the finer characteristics looked for in a sample of barley for malting are of little use to a hungry animal and most farms outside of, as well as within, the traditional barley-growing areas include some fields in which a satisfactory crop can be grown for feeding purposes. It is realised that the inability of the varieties hitherto available in this country to stand on the heavier and richer

soils is a real obstacle to the cultivation of the crop in certain cases. This defect is not being neglected by plant breeders but until varieties more resistant to lodging become available in quantity we must make the best use of those that are available. It is not recommended that barley be sown in peaty or cold, retentive clay soils in exposed situations. Such soils are better cropped with oats. Barley is not tolerant of soil acidity to the same extent that oats is and advice should be taken as to the necessity for applying lime unless the field in which it is proposed to grow the crop is already known to be satisfactory in this respect.

For continued success from tillage, good sense must always be exercised in deciding the sequence of the crops. Indiscriminate cropping of a field with cereals until it has become impoverished and fouled with weeds is never wise. when, however, precautions are taken to keep weeds and soil-borne diseases suppressed, the growing of two cereal crops in succession is often feasible and, in cases, advisable. Satisfactory crops of barley can often be got after another cereal crop where, otherwise, excessive lodging would occur. Clean soils in good heart which grew wheat last year may be expected to give a good crop of oats or barley this year. If, in ground where, last year, wheat was affected by Take-all disease, a cereal must be grown again this season, oats should be used, since only in a few cases has appreciable damage to oat crops by the disease been recorded in this country. Except, perhaps, in occasional instances where for unavoidable reasons, work has been unduly delayed ploughing will have been finished before now and the cropping of each field decided. Any farmer, however, who finds that he could reach upon a little more tillage than he has already planned for this season and who has a suitable field which was laid down to grass 4 or 5 years ago after being well manured and has since been mostly grazed, need not hesitate to plough it, even at this date, for a barley or oat crop. If it is foreseen that it will not be possible to work this field into the normal rotation next year it can be seeded, immediately after sowing the cereal with Ryegrasses and Clovers for grazing until it becomes due for tillage in the normal way again. There may be other cases where farmers who intend to sow swedes, turnips, or kale in good, clean ground which grew a lea cereal crop last season, could conveniently and to their own advantage grow oats or barley there instead and break lea ground for the root crops mentioned.

It must be assumed that farmers generally have either retained seed oats from last year's crop for sowing this season or have already arranged to get it from other growers or merchants. Those who still require seed should take immediate steps to procure supplies locally. The attractiveness of a bright-coloured, clipped sample of seed oats is often over-valued. Provided the grain is well-filled, well-dressed and has good germinating capacity, it will make good seed. There is now no necessity to consider more then 3 or 4 varieties of white oats to find one to suit conditions in any locality. Where there is a choice in the matter, choose Glasnevin Ard-ri for naturally fertile soils and well manured ground where varieties such as Victory would be likely to lodge;

farmers who favour Potato oats should avail of the first opportunity to get into a stock of the Ardee strain of this variety ; in all other cases use Victory II or Glasnevin Success. The latter variety is shorter in the straw, somewhat more resistant to lodging and ripens about a week earlier than Victory II but the grain quality is not quite as good.

Where the produce of the barley crop is expected to be sold for malting, the variety Spratt-Archer 37 No. 3, the grain of which is of superior malting quality, should be grown. In experiments carried out over many years it has been found to be a better yielder than any of the varieties with which it was compared. In view of this, it is the variety to grow for feeding purposes also wherever soil and weather conditions are found to suit it. In certain districts where barley is grown solely for feeding and where other varieties have been found better suited to the conditions which prevail there, farmers who have not been accustomed to grow this crop would be well advised to follow successful local practice in regard to choice of variety and general cultivation of the crop.

There is still a tendency in some districts to be satisfied with seed oats containing a high proportion of light grains which are unable to produce vigorous plants and an attempt is made to compensate for the poor quality by sowing extra seed. The result is an excessively thick braird, much straw and grain which, in quantity and quality, is disappointing when compared with the early appearance of the crop. Better results are obtained by sowing well-screened, vigorous seed at a lower rate so as to get a moderate stand of strong plants having the necessary room to develop good heads of well-filled grain. Where lodging is feared it is better to err on the side of rather thin sowing than to have the crops too thick.

Cereal crops which would otherwise be excellent are frequently robbed of moisture and plant food, deprived of adequate sunlight and rendered difficult to harvest by the presence of weeds. Moreover, anyone looking at a field of Charlock or Poppies in flower during the summer months and knowing that these species may produce up to four thousand and fifty thousand seeds respectively on a single plant must contemplate with regret on the years of labour or loss of crop yield that will likely result from the crop of weed seeds produced On the drier soils where Poppies and Charlock are frequently prevalent, a measure of control which might be more often employed is to prepare the seed bed for oats and barley in time to allow a crop of weed seedlings to come over ground and destroy them by surface harrowing them before sowing the crops. A good surface harrowing of these crops in the early grass-corn stage also, weather permitting, usually helps considerably in the destruction of weed seedlings. The spraying of cereal crops with 3 per cent. copper sulphate solution for the control of Charlock should be carried out when the plants are not more than 3 or 4 inches high.

EMERGENCY LEYS.

Broadcast Talk by PROFESSOR M. J. GORMAN, University College, Dublin, given on Thursday, 30th March, 1944.

In order to remove any misunderstanding which might arise regarding the meaning of the title of this talk, I should say at once that what I have in mind is not necessarily some special kind of ley peculiarly adapted to the circumstances of the emergency. What I propose to discuss in a general way is the importance of leys in their relation to the national food-production campaign and to emphasise once more a fundamental principle, viz. : that well-managed grassland is the key to productive tillage. Leys are a familiar feature of our agriculture and are characteristic of what is commonly called mixed farming or alternate husbandry. Sometimes and more frequently during the past few years, this type of farming is referred to as "Ley Farming." It is the system of farming practised in what we call the tillage districts of this country where oats, barley, beet, sometimes potatoes and latterly wheat are grown for market. At the same time considerable numbers of livestock are kept and winter feeding ensures more or less abundant supplies of farmyard manure. After three to five years in tillage the land is laid down or "let out" with a seeds mixture of grasses and clovers; a crop of hay (maybe two) is taken and grazing follows for three to five years when the land is broken again and the tillage rotation starts once more usually with a crop of oats the first year.

Experience has proved that by this system of using arable land, *i.e.*, alternating tillage crops (some of them being manured) with grass, the highest yields of food and fodder crops may be secured and at the same time the land itself may be most easily kept in a clean, workable, and fertile condition. It is important to have an understanding of some of the ways in which the ley operates towards the achievement of these highly desirable results. On many tillage farms it is only too obvious that the function of the ley is not understood. After more or less heavy first crop hay the lay deteriorates rapidly becoming weedy and unproductive. The sown grasses and clovers die out and are rapidly replaced by poor grasses and weeds. The causes of this are various. It is due essentially to the fact that in the past farmers have not given to the ley the same care as they have to their tillage crops. They have not in fact treated the ley as a crop, not merely for the first year or so, but throughout its life. The ley differs from other farm crops in many ways. To begin with it consists of a mixture of grasses and clovers—not just one thing like a crop of oats.

Merely by looking at a crop of oats a farmer can tell whether it is doing

well or not and to what extent, for example, it is being over-run with weeds. With a ley it is not easy to see how each of the different species is doing and the farmer has to judge by the general appearance of the sward. It frequently happens that some of the grasses and clovers sown never appear at all, and make no contribution whatever to ley or pasture.

A ley also differs from a tillage crop in that once it is sown it *must* hold the ground for three, four, five years or more. Consequently, it is important that the grasses and clovers sown in the ley should be long-lived types and not such as will die out after a year or so, to leave bare ground for invasion by grassland weeds.

Furthermore, once a tillage crop is harvested it is not expected to produce another from the same root. A ley on the other hand has to submit to mowing and grazing for several years. Grazing, properly managed it is true, improves the ley, but grazing as often practised, far from improving the ley, leads to the rapid weakening and extermination of the better grasses and clovers. Finally, in this comparison of a ley with other crops there is the matter of manuring.

Potatoes, roots, beet or even cereals are not expected to give a high yield without proper quantities of farmyard manure or other fertilisers. It must be admitted that the case of leys is not perhaps strictly comparable with that of other crops in that the leys receive manure from the grazing animals. At the same time it must be remembered that the grazing animals only return to the pasture a portion of what they have already received from it. Certainly in the case of pastures grazed by young animals and heavily milking cows the drain of nutrients from the soil is considerable.

The implication, therefore, is that a ley to be successful, will have to be treated more or less as other crops are, and consequently attention must be given to three things :—

(1) The seeds mixture;
(2) the fertility of the soil, and
(3) the management.

I will discuss the seeds mixture first and assume that the ley is to remain undisturbed for three to five years. It is obvious in the first place that the mixture ought to contain grasses and clovers that may be expected to persist for at least the duration of the ley. It is a bad policy to include in the mixture (except in small amounts) shorter lived types such as Italian Rye Grass, Broad Red Clover or Ordinary White Clover except in the rather unusual case where the ley is sown without a nurse crop, grazed from the start and no crop of hay taken. Short-lived types are fast-growers and tend to smother the longer-lived but less rapidly-developing types. When they die out after a year,

they leave bare ground which is rapidly occupied by grassland weeds such as daisy, plantain and buttercup.

It is not necessary or useful to sow a great variety of species. Three or four grasses and two or three kinds of clover carefully chosen are quite sufficient. Among the grasses Perennial Rye Grass always heads the list. It is our best pasture grass. It gives a high yield, is palatable, lasts well in fertile soils and remains green in the winter. Cocksfoot comes next in order of merit, but supplies of seed are rather short this season.

Timothy, an excellent hay grass and one of the most palatable of the pasture species, ought always to be included in the mixture. The seed is relatively cheap. It is one of those grasses which is very sensitive to competition in the early stages of its growth and is liable to be smothered by fast-growing rye-grass and Red Clover. For that reason a generous seeding is necessary. It may be taken as an axiom that a ley in which clovers do not become rapidly and abundantly established is largely a failure. As hay and pasture plant clovers are valuable because they are rich in protein and minerals, both of which are essential for the proper nutrition of animals. But clovers are valuable in another way. If a clover plant is dug up carefully and the roots examined, it will be found that they have on them little swellings or nodules as they are called. It was thought for a long time that the nodules were something in the nature of disease. It has also been known and put on record for at least two thousand years that clovers, peas, beans and vetches make the ground where-ever they are grown, distinctly richer. It is not yet sixty years, however, since it was first shown that there is a connection between the root nodules and the fertilising effects of clover. Inside the nodules the nitrogen of the atmosphere is processed and built up into compounds which can be used by the clover plant. Clovers therefore, have not to depend upon the nitrogen of the soil nor do they need dressings of nitrogenous fertilisers such as sulphate of ammonia. Better still even, they gather from the air more nitrogen than they need themselves and this surplus is passed into the soil for the benefit of grasses and other un-noduled plants. In this way the soil of a well-managed pasture containing clover becomes richer in nitrogen from year to year. Tests have proved that the increase of nitrogen may be equivalent to dressings of several hundredweights of sulphate of ammonia applied annually. This fixation of nitrogen does not take place (to more than a slight extent) unless, clovers, trefoil, or some other members of the nodule-forming family are present in the sward. The value of clovers as fertility builders in the ley is therefore obvious. They stimulate the growth of the grasses and they help to create a store of fertility which is very valuable, and particularly welcome at the present time, for tillage crops when the pasture is broken.

The Red Clovers are especially useful in the early years of the ley but the longer-lived strains of the Single Cut or Montgomery type should, if possible, be used. For the pasture, Wild White Clover is indispensable. The seed of

Ordinary White is cheaper, but as it dies out in a couple of years, it fails to contribute anything appreciable to the pasture when according to the usual practice first crop hay is taken. I may now suggest a mixture for a three to five years ley, sown under a nurse crop, hay being taken the first year :

	lbs. per statute acre
Perennial Rye Grass	14–21
Italian ,, ,,	0–5
Cocksfoot	3
Timothy	5
Single cut cow-grass, or Montgomery Red Clover	2–3
Wild White Clover	½–1

The omission entirely of Italian Rye Grass is not likely to reduce the yield of hay. There is a widespread tendency to make the seeding of Italian Rye Grass too heavy with the result that the other constituents of the mixture suffer from smothering and then again, as I mentioned before, Italian Rye Grass dies out too quickly to be of much use in one of these longer leys. Its proper place is in one year leys and catch crops.

Passing more from the seeds mixture to the matter of the soil fertility, I need only emphasise once more that the better pasture grasses and Perennial Ryegrass especially will not thrive in poor soils. If these grasses—and the same applies to the clovers—are sown where the fertility is below a certain level they make little or no growth and rapidly die out. Their place is taken by Bent grass, Yorkshire Fog, and Grassland weeds of the numerous kinds that are able to flourish under poor soil conditions. The aim therefore, should be to have the land in as good heart as possible at the time the seeds mixture is sown. At the present time and as long as artificials are short, greater use than ever must be made of farmyard manure and composts during the rotation preceding the ley. Applications of lime help greatly towards a good establishment of the clovers. Top dressings with the cleanings of drains and ditches, as many farmers know, give excellent results on pastures.

I come now to the third factor which has a profound effect upon the quality of the ley. This is the management. While there is no doubt that the very best pastures are produced when the ley is grazed from the start, the taking of first crop hay (if it be cut early) does not cause much permanent injury, although it certainly delays the formation of a close pasture sward. The real danger is that the wild white clover will be weakened or killed by shading. Should this occur the ley will be seriously damaged. Hence, it is important to keep the aftergrass short too, and it should be grazed as soon as it is three or four inches high. Subsequent management becomes mainly a question of controlling the grazing. The system which seems to keep the ley in the best condition by maintaining a balance between the grasses and clovers is that in which the grass is allowed to grow to a height of three or four inches when

it is grazed hard and again rested until it makes a similar amount of growth. In practice this system may be difficult to carry out in detail and a compromise is necessary. The grazing management of most of our pastures certainly leaves room for considerable improvement. In the main our pastures are seriously overgrazed in the winter and spring and undergrazed in the summer. The result is that Perennial Rye Grass which starts growth early in the spring tends to be exterminated and Bent Grass which starts to grow later in the year and is less palatable is not grazed hard. Consequently it becomes the dominant grass in the pasture. In this way leys deteriorate. More winter fodder would help to prevent this.

But even with the best of management, it is difficult, except in the richer soils, to maintain a ley permanently in a high state of productivity. Red Clover and the high-yielding grasses tend to disappear. The ley is ceasing to be an effective fodder-producer for the reason that the real fodder producing-species are dying out. Before this has gone too far the ley ought to be ploughed up and the land which it occupies put to work again, growing a cereal or root crop, and incidentally making use of the fertility which the ley, if it has been properly managed, has been gathering and storing.

SUGAR BEET.

Broadcast Talk given by JAMES J. GLAVIN, B.Sc., N.D.A., Chief Agricultural Adviser, The Irish Sugar Company Ltd., on 14th April, 1944.

It is of paramount importance in these difficult times that the natural resources of the country—Agricultural and Mineral—should be utilised to the fullest possible extent and to the best advantage in the production of food for human and animal consumption. Blest with a soil and climate admirably suited to the production of farm crops and animals, there is no reason whatever why we should not produce within our own shores a sufficiency of food to meet the Nation's full requirements. Farmers, cottiers, plotholders, etc., have no doubt already answered the country's call for increased production of wheat, potatoes and other essential crops and I wish them every success and good luck in the great task they have undertaken for the nation.

It is my privilege to talk to you to-night on Sugar Beet—a crop of considerable economic importance and special significance to the Irish people in these critical times, for it provides not only part of our daily diet in the form of Sugar, but valuable by-products for man and beast and considerable employment for the people on the land, in the factories, and subsidiary industries. When speaking to you last year I appealed to all those connected with the Irish Sugar Industry—farmers, farm and factory workers, carrying companies, etc.—for their fullest measure of support and co-operation in whatever branch of the industry they may be engaged. I appealed to farmers in particular to grow not only more beet, but to produce more sugar per acre. I am now pleased to state, and I am sure that you will be glad to hear, that in the season concluded some months ago, 96,400 tons of refined sugar—sufficient to maintain the present generous ration for some considerable time to come—was produced in the four factories at Carlow, Mallow, Thurles and Tuam from beet grown and delivered in 1943 and the early part of 1944. Beet growers succeeded, despite an unfavourable season, and limited supplies of manure, in increasing the average output of sugar per statute acre from 1.23 tons in 1942 to 1.47 tons in 1943—an increase of almost one quarter of a ton of raw sugar per statute acre. The highly satisfactory results produced reflect great credit on beet growers and all others connected with the Sugar Industry and I take this opportunity of conveying to them the hearty congratulations and thanks of my Directors for their excellent performance and splendid co-operation.

You will be glad to know that arrangements are already completed for the

cultivation in the coming season of over 80,000 statute acres of sugar beet—the highest acreage ever grown in this country—and the maximum that the four factories are capable of processing satisfactorily. Farmers to whom contracts have been allotted and for whom a limited supply of fertilisers are reserved will already have begun preparing their land so as to sow early. Sugar beet seed, all produced at home, and of high-class quality, is now being supplied to all contractors and I would urge them in their own and the National interest to sow the crop as early as possible.

I would like to emphasise in this talk the importance of growing sugar beet in its proper place in the rotation. There has been a tendency lately for some farmers to grow beet in the same ground in succeeding years or after other root crops. Apart altogether from being a bad farming practice it is a highly dangerous one, for it not only depletes the soil of its natural fertility but promotes conditions conducive to disease and attack by insect pests. Continuous growing of beet in other beet-growing countries in the same ground has resulted in the land becoming infested with that dreaded pest known as "Sugar Beet Nematode" and the closing down of sugar factories. We are, as yet, free from this pest but there is grave danger that we may be faced with this problem at a future date if farmers were to adopt the mal-practice to which I have already referred. Beet growers should fully realise the importance of this grave warning and impress upon their neighbours the desirability of growing beet in its proper place in the rotation. The growing of sugar beet leaves the soil in excellent condition for wheat or other cereal crops and these are the crops which should follow it in the rotation.

While sugar beet can be grown successfully on most soils and in all parts of the country there are special points in its cultivation which require consideration and attention if economic and profitable returns are to be obtained. Haphazard methods of cultivation, manuring, singling, etc., invariably result in financial loss for the producer. This is instanced by the fact that in some areas within close proximity to the factories farmers only engage in beet production on a speculative basis, while in areas remote from factories beet production flourishes and now forms part of the normal rotation of practically every farmer. In last season when the average yield for the whole country was almost 9 tons per statute acre, Counties Cork and Galway produced average yields of 9.6 tons per statute acre, while County Meath, with its fertile land, produced only 7.4 tons per statute acre. The former yields, in my opinion, can be attributed more to better methods of cultivation than to any superiority in the fertility of the land, while the latter can be attributed to largely inferior and careless methods of cultivation.

Farmers in general only think of sugar beet in terms of yields per acre and sugar content, and the value of the crop is assessed by reference to these two factors. The sugar factory, however, is not so much concerned with the gross output of raw sugar per acre as it is with the net yield of extractable and

crystallisable sugar produced thereform. It is true that the Factory controls to some extent the sugar output, for growers must sow the seed supplied to them, but such seed is of the highest possible quality, having all the inherent characteristics and productive capacity for producing high yields, sugar contents, non-bolting, etc. Low sugar contents are often attributed to the quality of the seed, whereas the real cause is faulty and negligent cultivation. Sugar beet is one of the most highly bred of all farm plants. The root can contain anything from 12 per cent. to 24 per cent. of sugar, but its content of sugar will vary in accordance with its maturity. Generally speaking it requires in this country approximately six months for its full development, consequently early sowing is of major importance if the highest sugar contents are to be produced.

Sowing should be made as soon after the first week in April as soil and weather conditions will permit. When sown at this time, the resultant crop will have a full six months at least to attain maturity. Later sowings result not only in lower yields and sugar contents, but lower purity of the raw juices owing to the immaturity of the beet at harvesting time. The yield can be reduced by as much as 4 to 5 tons per statute acre when the date of sowing extends beyond mid-May. The contract acreage should be sown with the full quantity of seed supplied. A lower rate of seeding may, under ideal conditions, produce a good stand of plants, but the few extra pounds of seed is considered a good insurance against the danger of a poor stand. It may be argued that heavy seeding produces an over abundance of plants and increases singling costs, yet experience has taught that lighter seedings invariably produce irregular brairds with consequent uneven stands.

The motto of Beet Growers should, therefore, be—*Sow early and evenly on a well cultivated and prepared seed bed at a depth not exceeding ¾ inches.* A properly prepared seed bed should be of fine texture, deep, moist and above all. firm. A fine and firm seed bed ensures a sufficiency of moisture to promote rapid germination and subsequent rigorous growth of the young seedlings—the fundamental essential of subsequent root growth and development. Many crop failures are due to faulty sowing, either too shallow or too deep, and very often loosely prepared seed beds ; hence beet growers should exercise special care in this operation.

The next important operation is singling, or thinning as it is called in some parts of the country. This work should be performed immediately the young plants have developed four leaves. *Practical experience, as well as reliable experiments have shown that as much as one ton per acre can be lost for each week that singling is neglected.* Young plants are much easier to single and suffer less from crowding than do the larger ones and further, singling at this stage will disturb the plants less. The strongest and healthiest plants should be selected and all others removed. Singling to the strongest plants and at the correct time can influence the yield by as much as 3 to 5 tons per statute acre. The

cultivation in the coming season of over 80,000 statute acres of sugar beet—the highest acreage ever grown in this country—and the maximum that the four factories are capable of processing satisfactorily. Farmers to whom contracts have been allotted and for whom a limited supply of fertilisers are reserved will already have begun preparing their land so as to sow early. Sugar beet seed, all produced at home, and of high-class quality, is now being supplied to all contractors and I would urge them in their own and the National interest to sow the crop as early as possible.

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distance between the plants will vary in accordance with the width of the drills, but I would advise in the case of 20-inch drills, a spacing of not more than 9 inches, and likewise with 22-inch drills, 8 inches. The aim should be to leave about 35,000 plants to the statute acre. The work of singling cannot be done too carefully and should be closely supervised. I have seen many cases of singlers *removing the most convenient plants* instead of making *a careful selection of the* strong, healthy, vigorous growing ones.

The leaves are the manufacturing organs of the plant, forming sugar through the agency of chlorophyll and sunlight from water absorbed through the roots and carbon dioxide from the air. The leaves, therefore, are most important, and all possible steps should be taken during the growing period to promote healthy and vigorous leaf development. This is done by repeated horse and hand hoeings. The work of horse hoeing should be repeated weekly during the plants' early growth and continued up to the time that the leaves meet in the furrows. Hoeing not only destroys weeds but conserves moisture, loosens and aerates the soil and promotes conditions conducive to seedling growth and development. The space between each plant should be hand hoed for, like horse hoeings, this assists plant growth. Beet growers should remember that repeated horse and hand hoeings are as important as singling or manuring. Far too many growers mould up their crops early in the season forgetting the old saying "sugar is hoed into the beet."

Time does not permit me to dwell on harvesting the crop except to say that Sugar Contents can be maintained, lifting costs reduced and less hardship endured if growers harvested their crops during periods of favourable weather and store the produce in clamps for subsequent delivery to the Factory.

To sum up, I may be permitted to repeat briefly—Sow early on well-prepared seed bed. Single early, leaving the strongest and healthiest plants. Don't spare the horse and hand hoe. Harvest the crop during favourable weather.

In conclusion, I appeal to all those who will be engaged in the Irish Sugar Industry in the coming season to extend the same active support and co-operation as was so readily and splendidly afforded last season, and thus help to ensure production of the country's full requirements of that important food—Sugar.

GRASS SILAGE.

Broadcast Talk given by JOHN O'LOAN, A.R.C.Sc.I., B.Agr.Sc., N.D.A., Department of Agriculture, on 4th May, 1944.

It is just possible that to some farmers in this country grass silage is still such a novelty that it is necessary to begin by explaining exactly what it is. Grass silage in its simplest form is grass which has been preserved in its succulent condition by fermentation or pickling in its own juice. In the making of the silage the grass may be treated with dilute treacle or with mineral acids but these are not essential to the making of good silage.

It is unnecessary to tell farmers that spring and summer grass is the most perfect cattle food which can be produced. Dairy farmers producing milk for sale in cities and towns and those supplying creameries know that their feeding difficulties are ended once the grass has reached the stage at which the cows can be allowed out on it. Graziers are aware that prime beef can be produced more quickly on our good pastures than by any other system of feeding.

For generations the majority of us have accepted the saving of hay as the only means of storing up summer grass for winter feeding, and average quality hay only maintains animals in store condition. To produce milk or meat it requires to be supplemented with concentrated foods which in the past were usually in the form of imported cakes and meals. Only a relatively small number of farmers in this country before the war knew or believed that it was possible to preserve summer grass in such a way that practically its full summer feeding value could be availed of in winter and that for the feeding of even comparatively heavy milking cows or fattening cattle it was unnecessary to feed concentrates if good grass silage was available. Although the Department of Agriculture has made a continuous effort over forty years to popularise silage making it is only since imported concentrates ceased to be available that anything like a reasonable number of farmers have adopted it and even still the rate of progress is far from satisfactory. The difficulty would appear to be partly one of overcoming scepticism and partly due to the fact that many who in the past tried to make silage did not exercise sufficient care and the results were so disappointing that neither they nor their neighbours had any further interest in the process. The making of silage is not a particularly difficult operation but it would be altogether misleading to suggest that it does not require care. Like many other farm operations there are a number of points in silage making which must be fairly rigidly observed if the best results are to be obtained. Carelessness or the adoption of short

cuts usually lead to disappointment. I do not propose to explain here how to make silage and in any case you would probably have forgotten some, if not most of the essential points, before you have an opportunity of putting them into practice. Those who intend making silage should read carefully Leaflet No. 105, issued by the Department of Agriculture and should request the local Agricultural Instructor to give the necessary advice and assistance.

There are two or three slightly different ways of making grass silage, each suited to particular conditions of farming, and advocates of a particular system often recommend their way as being the only one worthy of consideration, irrespective of the conditions. After years of experience and experiment it has been decided that for the vast majority of farmers in this country the best system of making silage is by using specially constructed concrete silos, preferably circular in shape. Such silos enable silage of the highest possible quality and with the least possible waste to be produced and it is evident that the future of silage making in this country depends on these two factors—highest quality and absence of waste. Farmers who have been making silage for years are often in doubt as to what is a reasonable amount of waste to expect in a silo and many appear to accept it as inevitable that a considerable proportion of the herbage put into the silo will eventually be fit only for the manure heap. In the case of concrete circular silos of approximately 16 ft. diameter and 9 ft. high, which have become more or less standard in this country and which hold thirty to thirty-five tons of silage, the amount of waste on top should not be more than half a ton or, approximately, a good cart load. There will usually be some mouldy material round the wall at the top. This is due to the grass having been built a few feet above the top of the silo or superstructure and is difficult to avoid but it should not extend beyond about two feet down in the silo. Over the remainder of the top the waste should not exceed two or three inches in depth. From that downward there should be nothing in the silo but perfectly cured silage. In cases where waste in excess of this amount occurs advice should be sought as to the cause. Absence of waste is nearly always associated with high quality silage while excess of waste nearly always means that the bulk of the silage is badly cured.

Regarding quality in silage, it should be realised that the best quality silage is not necessarily that which stock eats most readily. Brown silage which is the type usually made in clamps and stacks and is the result of high temperature is eaten greedily by all stock. This is responsible for a lot of the enthusiasm of advocates of this type of silage. In actual fact, however, the feeding value of this silage may be very low, depending on the height to which the temperature rose. Good quality grass silage in which the temperature has not been allowed to rise above blood heat is dull green in colour with a somewhat sour but not pungent smell. Some cattle eat it greedily from the start but others require to be started gradually.

Provided the silage is properly cured its feeding value approximates to that

of the grass from which it is made. If the grass has been cut while the bulk of it was still in the leafy stage it will produce results comparable with those which might be expected from grass of similar quality grazed in the ordinary way. Thus for moderately heavy milking cows or fattening cattle, good grass silage does not require to be supplemented with concentrates. A further point of the utmost importance in favour of silage is that the Vitamin A content of the grass is preserved. Vitamin A increases the resistance of animals as well as of humans to disease, and foods rich in it are, in consequence, referred to as protective foods. When such a food is fed to milking cows the protective quality, or in other words, the high Vitamin A content, is transferred to the milk and to the butter made from the milk. This quality is not something abstract or invisible which one is asked to accept without being able to see. Those accustomed to handling milk and butter are well acquainted with the bluish white colour of winter milk as compared with the cream white colour of summer milk, they are also acquainted with the hard texture and lack of colour in winter butter as compared with the soft texture and rich colour of summer butter. These differences are often attributed to a higher percentage of fat in summer milk and to the effect of cold on the winter butter. Actually they are due to the carotene or vitamin A content of the grass, and milk and butter from cows fed on silage in winter have both the colour and texture as well as the protective qualities of summer milk and butter. In many countries tnis fact is recognised to the extent that a premium is paid for milk from silage-fed cows for use in children's hospitals and schools. I will refer briefly to this quality of protection from disease later.

In an effort to expedite the spread of silage making in dairying districts the Department of Agriculture about five years ago induced a number of farmers in Counties Cork, Limerick and Tipperary to erect concrete circular silos. Altogether thirty of these silos were erected in groups of six, each group being situated where possible in the collection area of one creamery. The creamery districts concerned were Ardmayle in County Tipperary, Mitchelstown and Charleville in County Cork and Shanagolden and Kilmallock in County Limerick. The principal idea in having these silos erected was to give farmers in each of these districts an opportunity of observing the results of silage-making on a number of farms and of drawing their own conclusions. A further object was to give the farmers who erected the silos an opportunity of making silage by three different methods—one, using molasses ; two, using mineral acids, and three, without either of these treatments, so that a practical expression of opinion on the relative merits of these three processes would be obtained. It had been hoped that you would have had the pleasure this evening of hearing a number of these farmers express their views on silage, but transport difficulties have unfortunately intervened to make that impossible. A report on the work was published in the *Journal* of the Department of Agriculture for March, 1943. A limited number of copies of the report are available and may be had on applying to the Department.

It was arranged that two farmers in each of the five creamery districts

should each year make grass silage by one of the three systems already mentioned—that is, using molasses, using acid or by ordinary fermentation. After the second year and when twenty of the thirty farmers had tried out each process, supplies of acid ceased to be available. It was then obvious, however, that the question was not one of by what method silage should be made. Perfectly cured silage was made by all three methods and the question became one of the merits of grass silage as such. After one year's experience quite a number of the farmers increased the height of their silos, adapted an existing building to the purpose of making silage or built a second silo. In the Shanagolden area one farmer fed his cows entirely on silage and winter pasture. One of the cows on this ration was producing five gallons daily and maintaining her condition. For one month the fat percentage of the milk of this herd was ·5 above the average of the creamery. In another district the owner of a thirty-acre farm increased the size of his silo to hold over eighty tons and converted all his grass into silage, and has made practically no hay since.

There has not been a single case of white scour in the calves for the past five years on any of the farms on which these silos were erected although prior to that time scarcely a season passed in which calves were not lost from this disease on some of them. This is strong circumstantial evidence of the protective value of silage and indicates that it is conveyed to the calves of cows fed on silage.

These farmers have all found that silage enables them to bring their cows through the winter in good condition and that they milk to their maximum capacity immediately they go out on grass instead of having to build up flesh on emaciated frames.

In some of the districts where these silos were situated, neighbouring farmers were quick to appreciate the advantages of silage and many silos were erected. In other districts the response was much slower and by the time some farmers had decided to erect silos, materials had increased in price, and, as a result of increased tillage, time and labour were available for only essential farm work. The difficulty which farmers in predominantly dairying and grazing districts have had to overcome in the past few years are fully appreciated. Nevertheless there are many who realise what a boon silage would be to them and who by a small extra effort could erect a silo. The work can be done entirely by farm labour and although cement, which is the principal item in the cost, has increased somewhat in price, a grant is provided by the Department of Agriculture under the Farm Improvements Scheme amounting to half the approved labour cost of construction, subject to a maximum of £10. This considerably reduces the cost. In addition County Committees of Agriculture provide on loan moulds for making concrete blocks for circular silos and all necessary advice can be had from the Agricultural Instructor.

NOTES ON THE EMERGENCY POWERS (No. 296) ORDER, 1943.

(COMPULSORY TILLAGE FOR 1944).

1. The Emergency Powers (No. 296) Order, 1943, provides, subject to certain exceptions which are mentioned in paragraph 13 of these Notes, that every occupier of five or more statute acres of arable land shall in 1944 cultivate, in accordance with proper methods of husbandry, an area, referred to as the tillage quota, equivalent to at least three-eights of such land. Furthermore, portion of the area cultivated by each occupier must be sown with wheat, such portion being referred to as the wheat quota. The wheat quota varies according to the district in which a holding is situated and for this purpose the country has been divided into three districts, known as Districts No, 1 No. 2, and No. 3, as specified hereunder. The wheat quota for District No. 1 is one-tenth of the arable area of each occupier's land; for District No. 2, one-sixteenth of the arable area, and for District No. 3, one twenty-fifth of the arable area.

District No. 1.

(*a*) the county boroughs of Cork, Dublin, Limerick, Waterford.

(*b*) the administrative counties of Carlow, Dublin, Kildare, Kilkenny, Leix, Limerick, Louth, Meath, Offaly, Tipperary North Riding, Tipperary South Riding, Waterford, Westmeath, Wexford, Wicklow.

(*c*) the administrative county of Cork, except—

(i) the urban districts of Clonakilty, Macroom and Skibbereen, and

(ii) the rural districts as constituted immediately before the 1st day of October, 1925, of Bantry, Castletown, Clonakilty, Dunmanway, Kanturk, Macroom, Millstreet, Skibbereen and Schull.

District No. 2.

(*a*) the administrative counties of Clare, Kerry, Longford, Roscommon.

(*b*) the administrative county of Galway, except—

(i) the rural districts as constituted immediately before the 1st day of October, 1925, of Clifden and Oughterard, and

(ii) that part of the rural district as constituted immediately before the 1st day of October, 1925, of Galway west of the river Corrib.

(*c*) that portion of the administrative county of Cork comprising—

(i) the urban districts of Clonakilty, Macroom, Skibbereen, and

(ii) the rural districts as constituted immediately before the 1st day of October, 1925, of Bantry, Castletown, Clonakilty, Dunmanway, Kanturk, Macroom, Millstreet, Skibbereen and Schull.

District No. 3.

(*a*) the administrative counties of Cavan, Donegal, Leitrim, Mayo, Monaghan, Sligo.

(*b*) that portion of the administrative county of Galway comprising—

(i) the rural districts as constituted immediately before the 1st day of October, 1925, of Clifden and Oughterard, and

(ii) that part of the rural district as constituted immediately before the 1st day of October, 1925, of Galway west of the river Corrib.

It is provided in the Order that the growing of rye shall be regarded as compliance with the wheat quota requirement in District No. 3.

2. The Order takes effect notwithstanding any covenant, agreement, condition or provision as to the user of the " holding " and no such covenant etc., shall operate so as to penalise, impede or interfere with the cultivation required by the Order. Land let on the eleven months' system comes under the Order and the obligation to cultivate the requisite area in respect of such land lies on the person rated or liable to be rated for it, or on such other person as is deemed also to be the occupier of the holding for the purposes of the Order as indicated in the following paragraph.

3. *Definition of Occupier.*—An occupier is defined as the person who is rated or liable to be rated in respect of the land. If, however, the person so rated or liable to be rated does not himself care and manage the land, then any person who is authorised to make lettings of the land on behalf of the actual occupier or (where no such authority exists) who cares and manages the land, is deemed, for the purposes of the Order, to be also the occupier.

4. *Definition of " Holding."*—For the purposes of the Order an occupier's " holding " means all the arable land (*i.e.*, land capable of being tilled) in his occupation in the State. If he has two or more farms he must cultivate at least three-eighths of the total area of arable land comprised in all the farms including the appropriate wheat quota.

5. *Arable Land.*—" Arable " means capable of being tilled. Building lands, if arable, come, therefore, within the provisions of the Order as do also demenses, save parts thereof on which timber would interfere with the cultivation or harvesting of crops.

6. *Non-arable Land.*—The following are examples of land which will be regarded as non-arable and, therefore, not within the scope of the Order :—rough mountain grazing, unreclaimed bog, sand dunes, land regularly subject to flooding, land under timber, land recently planted for forestry purposes and land on which the cultivation and harvesting of crops would be interfered with by timber.

7. *Meaning of " Cultivation " or " Tillage."* —Cultivation or tillage comprises ploughing together with the subsequent operations necessary for the

production and harvesting in 1944, in accordance with proper methods of husbandry, of the ordinary farm and garden tillage crops, *i.e.*, cereals, potatoes roots, vegetables and other green crops, as well as flax and tobacco. It should, however, be observed that for the purposes of the Order, the growing of rape does not rank as cultivation. Any part of a holding sown in 1943 with a winter cereal for harvest in 1944 will be regarded as having been sown in 1944. An occupier will be liable to immediate prosecution after 15th July, 1944, if it is found that the required quotas have not been tilled by that date.

8. *Land laid down to grass.*—First year's grass to an extent not exceeding one-fourth of the tillage quota will be allowed to count as cultivation for the purposes of the Order provided that it has been sown in accordance with proper methods of hubandry, either with a cereal as nurse crop in 1943, or following a 1943 tillage crop, so as to mature sufficiently for meadowing or grazing in the year 1944. Where the area laid down to grass is less than one-fourth of the tillage quota, the balance of the area constituting the tillage quota must be cultivated with a tillage crop or crops as defined in the Order. For example, on a holding comprising 64 statute acres of arable land the tillage quota is 24 statute acres but first year's grass will count towards the quota to an extent not exceeding 6 statute acres. If there are only 3 statute acres of first year's grass on the holding the area to be cultivated under ordinary tillage crops is 21 statute acres including the wheat quota. If there is no first year's grass on the holding the entire 24 statute acres, making due provision for the wheat quota, must be cultivated under the ordinary farm and garden tillage crops.

9. *Nurseries and Orchards.*—Land used as nurseries for the propagation of fruit and forest trees or ornamental shrubs and bushes will be regarded as cultivated. Orchards, if properly planted and mânaged, will be regarded as cultivated.

10. *Direction to cultivate specified part of "Holding"*—The Minister for Agriculture may require an occupier to (*a*) cultivate the whole or part of his tillage quota on a specified portion of his holding; (*b*) sow the whole or part of his wheat quota before a specified date; (*c*) sow the whole or part of his wheat quota before a specified date on a specified portion of his holding.

11. *Conacre tillage and Allotments.*—If an occupier arranges for the cultivation of his holding in 1944 either in conacre or by allotment holders such cultivation will, for the purposes of the Order, be regarded as cultivation by the occupier.

12. "*Holdings*" *to which the Order does not apply.*—As indicated in paragraph 1 of these Notes the Order does not apply to a "holding" comprising less than five statute acres of arable land (see also paragraph 4 of these Notes). Neither does it apply to a "holding" which is or forms part of a public park, public recreation ground or an aerodrome.

13. *Permissive exceptions or exemptions.*—The Minister for Agriculture may, on the application of the occupier, declare a "holding" or a part thereof to be excepted from the provisions of the Order if he is satisfied that the entire "holding" or a part thereof is required in the year 1944 for industrial purposes or had been required and regularly used in 1943 and is required in 1944 for the following purposes :—

(a) accommodation for live stock intended for disposal at auctions, fairs or markets, or for shipment or for slaughter ;

(b) the maintenance of a stud of high-class thoroughbred horses, consisting of breeding animals, foals and yearlings ;

(c) track of racecourse or a paddock, ring or other enclosure adjacent to the stand or stands of a racecourse ;

(d) track for the training of racehorses by a licensed trainer ;

(e) agricultural or industrial show grounds ;

(f) games conducted by recognised clubs and

(g) college and school playing fields.

14. *Application for declaration of exception.*—Applications for declaration of exception must be made not later than 1st December, 1943, on Form T.1. which may be obtained from the Department. In many cases, lands used for industrial purposes or as an accommodation or butcher's paddock, a sports ground, playing field or show ground constitute the entire "holding" and comprise less than five statute acres of arable land. In such a case the lands do not come within the scope of the Order and no application for their exception is required. If, however, lands so used form only part of the "holding" or include five statute acres or more of arable land, a declaration of exception must be sought by the occupier if he desires relief from his obligations under the Order. The onus of proof that land should be excepted from the provisions of the Order lies on the occupier and he will not be relieved of his obligation to cultivate simply by the fact that he has made an application for exception.

15. *Lands not used for the purpose for which they were excepted.*—A declaration of exception is, of course, only valid in case the lands are used in 1944 for the purpose for which the declaration is granted. An occupier who obtains a declaration of exception in respect of all or a portion of his lands but who does not use them in 1944 for the purpose for which they were excepted must therefore till them, or till in respect of them, to the extent prescribed by the Order.

16. *Requirements of the Order in case part of a "holding" is excepted.*—If the Minister has declared that a portion of a "holding" comes within one or more of the exceptions set out in paragraph 13 of these Notes, the acreage to which the Order applies is the arable land comprised in the residue of the "holding." Thus, for example, a person occupying one hundred acres of

arable land, of which thirty acres are excepted, would, for the purposes of the Order be regarded as occupying not more than seventy acres of arable land. If, after allowing for the excepted portion, the residue of arable land in the "holding" does not amount to at least five statute acres no part of the "holding" need be cultivated in order to comply with the requirements of the Order.

17. *Wheat-exempted "Holdings."*—Application may be made to the Minister for Agriculture not later than the 1st December, 1943, on a form prescribed, for a declaration by the Minister that the holding set out in the application is a wheat-exempted holding. A holding may be exempted from the wheat quota provided that it comprises only ten statute acres or less of arable land and that it has been used during the year 1943 solely for the growing for marketing in the State of fruit and/or vegetables (including potatoes) and is required solely for the same purpose during the year 1944.

18. *Inspection of lands.*—Any person duly authorised by the Minister for Agriculture may, for the purposes of the Order, enter on and inspect any land or building and no one may lawfully obstruct or interfere with any person so authorised when carrying out such inspections.

19. *Penalties for non-compliance with the provisions of the Order.*—Failure on the part of an occupier to comply with the provisions of the Order constitutes an offence under the Emergency Powers Acts, 1939 to 1942, and renders him liable to prosecution and on conviction to a fine not exceeding £500 or imprisonment or to both fine and imprisonment.

Moreover, the Minister is authorised (i) to take immediate possession of a holding which the occupier did not take reasonable steps to cultivate in 1943, or which was unoccupied in 1943, or on which the occupier failed to comply with the requirements of a direction, as indicated at (a), (b) and (c) in paragraph 10 of these Notes, which had been served under the provisions of the 1943 season's Tillage Order; (ii) to retain possession of a holding entered in 1943; (iii) to re-take possession of a holding which was entered in 1943 and has been surrendered to the occupier; (iv) to take possession of a holding in respect of which the occupier has not complied with the requirements of a direction, as indicated at (b) and (c) in paragraph 10 of these Notes, served under the Order, and (v) to take possession of any other holding on or after the 14th January, 1944, if he is satisfied that the occupier has not taken reasonable steps to comply with the Order or to comply with the requirements of a direction as indicated at (a) in paragraph 10 of these Notes. The Minister may cultivate any holding of which he has taken possession or arrange for any person to do so on such conditions as the Minister may direct.

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AGRICULTURAL INSTRUCTORS' CONFERENCE — DUBLIN, 1944.

Keogh Bros. Dublin.

CONFERENCE WITH AND COURSE OF LECTURES FOR INSTRUCTORS IN AGRICULTURE.

A conference was held on the 26th September, 1944, between Officers of the Department and the County Instructors in Agriculture at Science Buildings, Upper Merrion Street, Dublin. The conference was addressed by Dr. James Ryan, Minister for Agriculture, and was presided over, at different times by Mr. D. Twomey, Secretary of the Department, Mr. Seán O Broin, Assistant Secretary and Mr. T. O'Connell, Agricultural Director. Various aspects of the Department's policy, the work of the Instructors and other matters relating to agriculture were fully discussed.

On the days following the conference lectures were delivered to the Instructors in different branches of Agricultural Science. The lecturers and the subjects chosen by them were :—

Professor M. Caffrey, B.Sc., A.R.C.Sc.I., Albert Agricultural College, Glasnevin—*Identification of wheat varieties by the latest modern methods.*

Professor E. J. Sheehy, F.R.C.Sc.I., D.Sc., Albert Agricultural College, Glasnevin—*The practical application of recent advances in animal nutrition.*

Professor M. J. Gorman, B.Sc., A.R.C.Sc.I., Albert Agricultural College, Glasnevin—*The making and management of pastures.*

J. Carroll, D.Sc., B.Agr.Sc., Albert Agricultural College, Glasnevin—*Present-day knowledge concerning some insect pests of farm crops.*

J. D. Whitty, M.R.C.V.S., Chief Veterinary Officer, Department of Agriculture—*Present position in regard to the more serious livestock diseases.*

R. McKay, D.Sc., A.R.C.Sc.I., Albert Agricultural College, Glasnevin—*A summary of our knowledge of fungus diseases of cereals and methods of control.*

A. H. Lewis, B.Sc., Ph.D. (Lond.), F.R.I.C., Jellott's Hill Research Station, Bracknell, Berkshire, England—*Laboratory examination of soils and the practical interpretation of results as a guide to fertiliser practice.*

THE IDENTIFICATION OF VARIETIES OF BREAD WHEAT (TRITICUM VULGARE)

(Lecture delivered at a conference of Agricultural Instructors, 27th September, 1944)

By

PROFESSOR M. CAFFREY, B.Sc., A.R.C.Sc.I., Head of Plant-Breeding Division, University College, Dublin.

At the present time the duties of an Agricultural Instructor are more numerous and individually more complex than they were, say, thirty years ago. This applies particularly to that aspect of his work which is concerned with the giving of advice to farmers regarding the most suitable varieties of cereals to be grown on the various soils met with, and the identification of these varieties when grown. It is an accepted proposition that unless an Instructor is able to identify a variety when fully developed in the field, his knowledge of that variety cannot be regarded as complete.

During the first three decades of the present century the number of wheats grown in this country was limited. *Queen Wilhelmina* and *Squarehead's Master* were the dominant winter varieties, while practically the whole of the area devoted to spring wheat was seeded with *April Red* and *Red Marvel*. These four varieties are representative of well-marked distinctive wheat types, with contrasting characters so strongly accentuated and so obvious, that their separate identification is a comparatively simple matter even on a casual examination.

Now, the situation as regards wheat has become different. Instead of four, there are at least twenty-four varieties grown, but this increase in varietal number, although of itself embarrassing to the farmer and the Instructor, is not the only difficulty from the point of view of varietal identification. One of the real difficulties is that the great majority of the recently introduced varieties are strikingly similar. The agricultural requirements as regards wheat types suited for cultivation under present-day conditions necessitate the production of varieties having short stiff straw, dense beardless heads held erect at harvest, glabrous ears, and the prevailing fashion favours, in addition, white heads and white grain.

The identification of the modern wheat varieties is therefore no longer easy. A detailed examination of the plant, particularly of the organs of the ear, is necessary. A good lens is essential. All the information gleaned by wheat

specialists regarding the employment of the various contrasting characters—some of them very minute indeed—must be utilized. Even when all these matters have been attended to it is often difficult, in some cases, to make a definite identification of certain varieties. It still remains true that practical experience with varieties during all their stages of growth and development is necessary if serious errors in identification are to be avoided. My advice to Instructors is, therefore, to procure genuine seed stocks of the leading varieties, to grow them in small contiguous plots where their various reactions to the prevailing environmental conditions can be compared, and, at harvest, to take type-samples of the ears for future study. Instructors will find that a representative collection of these samples will be a desirable supplement to even the most complete identification "key," because there are numerous features of the various wheat characters which it is impossible to describe accurately in any form of words.

In dealing with the identification of wheats it is desirable to avail of two types of classification, *viz:* (1) the *botanic* and (2) the *agronomic*.

(1) Botanic Classification.

The botanic classification of wheat has had a history extending over 2,300 years, and in the literature on the subject, references will be found to the work of numerous investigations, including Theophrastus, Columella, Linnaeus, Lamarck, Percival and Vavilov. Vavilov's classification is not only the latest but the most complete, because, as the result of the Russian wheat-collecting expeditions, of which he was leader, numerous types and varieties previously unknown, were discovered and made available for study and research.

In his great classification of types of bread-wheat (*Triticum Vulgare*), Vavilov utilized only those characters which are clear cut, obvious to the eye and are not influenced by the soil and climatic conditions in which they are grown. Differentiating characters having these qualifications are known as major characters and they include presence or absence of awns, presence or absence of pubescence on the glumes and the lemmas, the colour of the glumes and of the grain.

Vavilov's classification divides the world collection of bread-wheats into two groups—one having ligules and auricles (*Ligulatum*) the other without these appendages (*Eligulatum*). All the forms appertaining to the latter group are rare and need not concern us here. Within the group *Ligulatum* he distinguishes four sub-divisions according to the degree of the development of awns and within these groups are comprised in all fifty-eight types. As all the wheat varieties grown in this country are represented in two of the sub-divisions referred to, it will only be necessary to give that part of the classification of these particular divisions which will comprise all our existing forms.

BOTANICAL KEY TO THE DETERMINATION OF VARIETIES OF BREAD-WHEAT (after Vavilov).

SUB-DIVISION I.

MUTICUM (BEARDLESS)

EARS GLABROUS	Ear white, grain white,	ALBIDUM
	Ear white, grain red,	LUTESCENS.
	Ear red, grain white,	ALBORUBRUM.
	Ear red, grain red,	MILTURUM
EARS PUBESCENT	Ear white, grain white,	LEUCOSPERNUM.
	Ear white, grain red,	VELUTINUM.
	Ear red, grain white,	DELFI.
	Ear red, grain red,	PYROTHRIX.

SUB-DIVISION II.

ARISTATUM (BEARDED)

EARS GLABROUS	Ear white, grain white,	GRAECUM.
	Ear white, grain red, (awns red)	ERYTHROSPERNUM.
	Ear red, grain white,	ERYTHROLEUCON.
	Ear red, grain red, (awns red)	FERRUGINEUM.

(2) AGRONOMIC CLASSIFICATION.

An examination of the above classification will show that it is not very helpful in the identification of our modern varieties. It is really a *type* and not a *varietal* "key." For example, within the type *Albidum* are comprised Queen Wilhelmina, White Stand Up, Wilma, Fenland Wonder, Million III, etc., and no assistance is provided by this classification for the identification of these individual varieties. It does not go far enough. Recognising this, workers in many countries have made a detailed examination of numerous bread-wheat varieties during all the stages of their growth and development, and

have found a number of additional differentiating characters which can be used for the identification of the varieties grown in their respective countries. Instructors are advised to consult the following publications :—

1. *Wheat in Great Britain.* John Percival. Leighton, Shinfield. Reading, Berkshire.

2. *Classification of Wheat Varieties Grown in the United States.* U.S.D.A. Washington. Bull. No. 459.

3. *Essai de Classification des blés tendres cultivés en France.* Pierre Jonard. Monagraphies Publiees Par le centre National de Recherches Agronomiques. (Versailles) No. 3.

In order to appreciate the new differentiating characters recently discovered and to assess their importance for diagnostic purposes it is desirable to follow the wheat plant through all the stages of its life history from the germination of the seed up to and including the ripening of the grain.

(i) *Germination and Plant Establishment:* When the soil conditions are favourable for rapid germination, a good wheat braird may be obtained in less than a fortnight after the sowing of the seed. If, however, the land be cold and wet, germination will take place very slowly indeed, and as much as two months may elapse from seeding before the young plants may appear above the surface of the soil. Therefore, although there are real differences between wheat varieties in regard to the rapidity with which germination and shoot emergence takes place, they cannot ordinarily be availed of as diagnostic characters, owing to the influence which the soil condition exerts on them.

The young shoot which comes overground is known as the *coleoptile.* It is rigid, tubular, pointed at the tip, and well adapted for forcing its way through the soil. Slight differences in colour between the coleoptiles of various wheat varieties are sometimes observable, but they are of doubtful significance in classification.

In the course of a day or two after the emergence of the *coleoptile* the first foliage leaf forces its way through the tip of the former. This particular leaf can be distinguished from those developed subsequently by its rather blunted tip. Subsequently the second and third leaves make their appearance—in quick succession, if conditions are favourable to growth—but if the crop is sown in early winter, only the first two leaves may develop before the renewal of active growth in springtime. The characters of these foliage leaves are not employed in classification.

(ii). *Production of Tillers:* When the wheat plant has produced its third foliage leaf it completes the primary stage of its development and immediately

enters on the second stage. This is known as the "grass-corn" or "vernalization" stage. One of the special features of this latter stage is the production of side-shoots or tillers. These are formed rapidly when the conditions—soil, weather and spacing—are favourable; and, on their formation, specific differences between varieties are immediately displayed. In some varieties the young tillers assume a prostrate habit of growth, they lie flat on the soil; in others the tillers are semi-prostrate; while in early-maturing spring varieties, the tillers remain erect. The behaviour of the tillers of any particular variety in relation to the habit of growth at this particular stage of the plant's development is—within the range of our climatic conditions—independent of soil, and is therefore a character of diagnostic significance.

It should, however, be clearly understood that this character can only express itself when the seeding is sufficiently thin to give each plant enough "elbow" room to enable the tillers which are formed to assume the growth habit characteristic of the variety. Moreover, this character, important although it may be, is one which is only observable at the "vernalization" stage of the plant's development. Once this stage has been completed, differences between varieties in respect of habit of early growth disappear and in the case of crops seeded at the normal rate leave practically no trace behind. This character is therefore of little use to instructors who are generally called upon at harvest or subsequently, to determine the varietal composition of a wheat crop.

There appears to be a high correlation between habit of growth and tillering capacity. The prostrate and semi-prostrate varieties will, other things being equal, produce a far greater number of tillers than the erect types. Tillering capacity, however, considered by itself, is not of any real value in classification, as it is so markedly influenced not only by the spacing, but also by soil fertility and time of sowing. Wheat growers are aware that quick-acting nitrogenous manures applied to a young wheat crop will increase the number of heads per acre at harvest, they are also well aware that winter wheat varieties will tiller abnormally when sown too late in the spring.

(iii). *Winter or Spring Habit of Growth :* The time required by any particular variety to complete the "vernalization" stage of its development is also a specific character of major importance in wheat identification. Differences between varieties in this respect are, however, only established when they are sown in spring. If a number of varieties comprising winter and spring types are sown in March or April they will all complete the first stage of their development and enter on the "vernalization" stage at approximately the same time. The winter types will, however, continue in the "vernalization" stage, profusely tillering until autumn, whereas the spring types will, after producing a few tillers, proceed to send up their flowering shoots. This character is, however, purely physiological in its nature and it is not correlated to any specific botanical character of the plant.

(iv). *Production of Flowering Shoots :* In the third stage of the development of the wheat plant some of the tillers, generally those formed earliest, will proceed to elongate while the remainder die away. A small proportion only of the tillers produced will proceed to form flowering shoots. The large number of tillers produced during the "vernalization" stage is apparently an insurance on the part of the plant against loss of shoots through various causes.

During the shooting stage, which is marked by the elongation of the stems and the formation and early development of the young ear inside the enclosing leaf sheaths, many useful observations may be made which will assist in varietal identification. It will be found that April Red and Aurora have auricles entirely glabrous, whereas the auricles of most other varieties are pubescent. Some varieties, like Diamant, have a rather dense growth of hairs on the leaf sheaths and blades, while, on the other hand, the leaf sheaths of Red Marvel are practically glabrous. As the time of ear exsertion approaches, the leaf tips of Red Marvel and Vilmorin's No. 27 turn brown and eventually wither. These two latter varieties can, at this particular point of development, be easily recognised from other varieties.

(v). *Reaction to Disease :* The reaction of the various wheat varieties to the several fungoid diseases which attack the crop in this country is not only a matter of great economic importance, but can also be of diagnostic significance when certain diseases are rife. During the seasons 1933 and 1934 a severe epidemic of mildew occurred on propagation plots on the College farm. One variety, Aurora, was not affected. If further experiments prove that Aurora carries immune or even highly resistant factors for this fungoid disease, it will prove to be of immense value for breeding purposes. Hitherto the only variety known to be immune to mildew was Persian Black—a low-yielding, weak-strawed poor sort, belonging to the wheat species (*T. persicum*).

Yellow rust (*p. glumarum*) is the most common of the fungoid diseases which attack wheat grown in Ireland. In trials conducted on the College farm, Turkey, Marquis, Diamant and Desprez 80, have proved to be exceptionally susceptible to attack. Badly infected crops of Diamant can be identified by the markings which the disease makes on the leaves of this particular variety. The reaction to this disease is a ready means of distinguishing Mars de Swede from April Red—the former being very susceptible and the latter highly resistant. Moreover, certain strains of Pajbjerg—a variety well suited for cultivation in this country on heavy soils—can only be identified from one another by the degree of resistance which they display towards this disease.

(vi). *Production of Ears :* During the earing stage the wheat plant attains the greatest development of its vegetative parts. Differences between varieties as regards the length and thickness of the stems are now apparent. Little reliance can, however, be placed on these characters owing to the extent to

which they are influenced by differences in soil fertility. The thickness of the stem-wall of the last internode, which is ascertained by making a cross-section of the stem at about six inches below the base of the ear, is a varietal character not markedly influenced by the environment, but there is so much variation in respect of this character among the stems of the same variety and even between the stems of an individual plant, that it can only be regarded as of minor importance.

It is in the characters of the ear that the clearest, the most important and the most lasting differences are found, and they will be relied upon almost exclusively in our analyses of wheat varieties.

The ear, or the spike, is made up of a number of sessile spikelets which are attached alternatively to opposite sides of a flattened, many-jointed and zig-zag rachis. Each spikelet is subtended at its base by two empty glumes and comprises a number of florets. With the exception of the terminal spikelet, these are set in a plane parallel to the flat surfaces of the rachis. Each floret has two flowering glumes, the *lemma* and the *palea*, and the male and female floral organs which are enclosed by these glumes.

The various structures which comprise the ear display in different varieties a number of contrasting characters. These are of the greatest importance in classification. Once formed, they are constant, they do not alter or disappear, and in addition they are, as a rule, far less influenced by soil and weather than are the vegetative characters of the young plant.

The following are the ear characters relied on in classification :—

Differences in the development of awns. Bearded and beardless.
- ,, ,, development of hairs on the outer side of the empty glumes. Felted and non-felted.
- ,, ,, colour of the glumes. Red and white.
- ,, ,, density and shape of the ear.
- ,, ,, size and shape of the empty glume.
- ,, ,, keel of the empty glume.
- ,, ,, beak of the empty glume.
- ,, ,, development of hairs on the inner surface of the empty glume.
- ,, ,, size of the watermark (l'empreinte) of the empty glume.
- ,, ,, beak and neck of the lemma.
- ,, ,, size, shape of terminal spikelet.
- ,, ,, development of hairs on the terminal internode.

(vii). *Development of Awns :* In respect of this character, bread-wheats are sharply divided into two classes—bearded and beardless. A bearded wheat is one in which the lemmas, or the flowering glumes are furnished throughout

the entire length of the ear with awns or beards more than two inches in length. A beardless wheat variety is one in which there is either no awn development at all, or in which the development of short awns, "awnlets," seldom exceeding half-an-inch in length, is confined to a few spikelets on the upper part of the ear. Awn development is uninfluenced by soil conditions, but there is some evidence that moist conditions during growth have the effect of slightly increasing the length of the awnlets in the case of beardless varieties.

(viii). *Development of hairs on outer surface of the glumes:* This character differentiates wheats into two distinct classes—felted and glabrous. It is uninfluenced by soil or climatic conditions and is therefore of major importance in classification. Some years ago, felted varieties, *e.g.*, White Velvet, Red Velvet, Red Stettin (certain strains) and Benefactor, were widely grown in this country. Their cultivation has now been abandoned because it has been discovered that the fine downy hairs hold moisture and provide excellent facilities for the growth of various fungoid diseases.

(ix). *Colour of the Ear:* The bread-wheats grown in this country can, when fully developed, be readily divided into red and white eared varieties. Differences between varieties in respect of ear colour, being uninfluenced by the environment, are of primary importance in classification. The full development of colour does not take place until some time after ear exsertion. If it is deemed necessary to have data in respect of this character before the colour normally develops, the ears should be steeped in a ten per cent. solution of alcoholic potash. This will rapidly develop a brown colour on the ears of red-ear wheat varieties. In seasons where there is a serious epidemic of "leaf blotch," it may occasionally happen that there will be difficulty in determining whether badly infected ears are red or white in colour. An examination of the edges of the glumes in particular those parts which the fungoid disease could not reach, will generally indicate the colour.

(x). *Density and Shape of the Ear:* The density and, to some extent, the shape of the ear are directly connected with the lengths of the internodes of the rachis. The average density is given by the following formula:—$\frac{l}{n-1}$ where l represents the length of the rachis, and n the total number of spikelets fertile and infertile, present on the ear. Density is a character which is influenced by soil fertility. There is a correlation between length of straw and mean length of internode in any particular variety. Tests carried out on the College farm revealed differences as high as thirty per cent. between the internodal lengths of contiguous plants of the same pedigree variety. Density is therefore regarded as being only of minor value as a diagnostic character in wheat identification. Nevertheless, it can be used for the separation of varieties displaying, under normal conditions, wide differences in this respect.

Three classes are generally recognised. Dense having the mean internodal length less than 3.5 millimetres. Queen Wilhelmina is typical of this class. Semi-lax, of which Red Marvel is a typical example, having an internodal length of from 3.5 to 4.5 mms. Finally, there are the lax varieties having internodal lengths of over 4.5 mms. Typical examples of this class are April Red, Red Fife and Diamant.

In regard to ear shape, wheats have the following general shapes—elliptical, clavate, oblong and fusiform. Elliptical or oval ears are only met with in *compactum* varieties and in crosses between compactum and bread-wheats. Clavate wheats, *i.e.*, wheats clubbed at the apex are quite common. Many strains of Queen Wilhelmina are of this type. The clubbing is due to the decrease of the length of the internodes in the upper portion of the rachis.

Oblong ears, *i.e.*, ears that are of the same width from base to summit are most common. They occur both in dense and semi-dense varieties. Typical examples of this type of ear are Little Joss, Squarehead's Master, Yeoman and Red Marvel. *Fusiform* ears—ears which narrow towards the apex—are mainly to be found associated with lax ears. Red Fife, Diamant and April Bearded Red are representative. Ear shape, however, is to some extent influenced by soil fertility and time of sowing, and is, therefore, only of minor value in classification.

(xi) *Empty Glumes.* (a) *Size and Shape.* If the empty glumes of an ear of wheat are examined minutely, small differences in regard to length, width, and shape will be apparent. It will be observed that the glumes of the spiklets occupying the middle part of the ear are the longest and widest, while there is a progressive and almost similar decrease in those particular characters towards, respectively, the summit and the base of the ear. A comparison of the glumes of different ears of the same pedigree variety will, however, show that the glumes of the spikelets occupying similar positions on the ears are closely similar. Therefore, in appraising glume characters, it is necessary to examine the glumes of particular spikelets and it is suggested that the lower glume of the fifth or seventh spikelet, counting from the base of the ear, should be chosen. It is also desirable before forming a judgment, to examine at least ten glumes, as the effects on shape and size of normal fluctication has to be allowed for. These particular characters are, however, of only minor importance.

(*b*) *The Keel.* The keel divides the glume into two unequal parts. It corresponds to the midrib of the foliage leaf of the wheat plant. The upper portion of the keel stands out as a sharply defined ridge in *all* wheat varieties, but there are differences between varieties as regards the appearance of this organ in the lower part of the glume. In some, it is clearly ridged throughout, in others its clear definition is lost or effaced in the body of the glume. Careful observation will, however, show that there are marked differences even on the same

ear in regard to this particular trait. There is, however, one contrasting character difference provided by the keel, which appears to be steady, and is uninfluenced in its expression by environmental conditions. The keel may be either straight or slightly hollow in its upper part. This is a rather minute character, but is probably of major importance in classification.

(*c*) *The Beak.* The keel terminates in the *beak*. In bearded varieties the latter is long and pointed, especially in the glumes on the upper part of the ear, but it is always short, rarely exceeding two millimetres in length in beardless types. Fenland Wonder has practically no beak, Svalof's Steel and the Wilhelmina group have very short blunt beaks, not more than one mm., others, like Little Joss and Ironmaster, attain a beak length of approximately two mm. In Japhet (Red Marvel) the beak is quite different from that of all other varieties grown in this country, it rises abruptly from the keel, is short and sharply incurved. The keels of Little Joss, Ironmaster and Mansholt's Van Hoek are also incurved.

(*d*) *The Shoulder.* The shoulder is that part of the glume which extends from the base of the beak to the edge of the larger face of the glume. Great variation exists even in the same ear in regard to the shape and width of this particular character. Generally, the shoulder is narrow and sloping in the glumes of the spikelets at the base of the ear, it is at its widest and squarest at the centre, while at the tip it becomes narrow and elevated. The junction of the shoulder to the lateral edge is rounded in some varieties, and very angular in others. All these differences, being variable, are only of minor importance in classification.

(*e*) *The Lateral Nerve.* On the narrow face of the glume a ridge known as the lateral nerve is well developed in some varieties. This nerve generally carries a number of stiff hairs at the base but in some varieties, *e.g.*, Scandia, they extend to over half the length of the nerve. Then two characters—the development of the nerve and the extent to which hairs are products—are quite useful for diagnostic purposes, especially in the case of the Scandinavian winter wheats, but they require for their identification the services of a good lens.

(*f*) *The Pubescence of the Inner Surface of the Glume.* If the inner surface of the glume is examined with a good lens, (magnification 15-20), it will be observed that it is covered with hairs. As these hairs are pointed towards the apex, their observation will be much facilitated if the base of the glume under examination is faced towards the source of light. Over the lower half of the glume the hairs are always short, bulbous, and thinly but evenly spaced. At the apex, however, these may be replaced by long, white, and silky hairs. The area over which these long hairs are developed on the upper part of the glume differs in different varieties and as this character is not influenced by soil or weather conditions it must be regarded as of major importance in

classification. The wheats grown in this country can in respect of this character be divided into three classes.

1. The development of long hairs occurs over more than one-third, but less than one-half of the larger face of the upper glume. In this group are Japhet, Mansholt's Van Hoek and Blé des Allies.

2. The development of hairs, somewhat shorter than those of class 1, is confined to the upper quarter of the glume. In this class are Wilhelmina and Aurora.

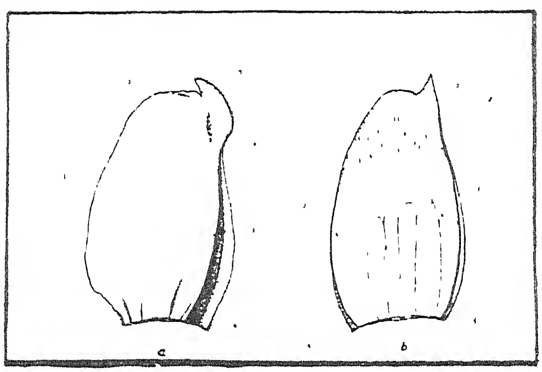
3. In this class there is practically no development of long hairs on the interior of the larger face of the glume. Yeoman 2 and Yeoman Ironmaster are typical wheats of this class.

(g) *The Watermark.* Another important diagnostic character of the inner surface of the glume is concerned with the development of a curious marking which has its origin, when present, at the base, and extends in some varieties up to more than three-fourths of the length of the glume. It resembles the watermark to be found on certain grades of paper. A close examination by the aid of a low-power microscope will show that this marking is devoid of the waxy covering which is present on the remaining portion of the glume's inner surface. In shape it appears to be made up of a number of lobes—from one to five—with rounded arches at the apex, the central one being the tallest. The separate lobes are sharply defined by the nerves of the glume. In Red Marvel, and in some of its hybrid derivations, the arches of the watermark are so well defined that when the glume is held to the light they appear as a well-defined sharp and dark line.

There appears to be a negative correlation between the thickness of the glume and the development of the watermark. Varieties like Marquis, Red Fife and Diamant, which have thick and rigid glumes, have the watermark either absent, as in the case of Marquis, or only slightly developed. On the other hand, in Queen Wilhelmina, Yeoman 2 and Pajbjerg, in which the glumes are relatively thin, the watermark is very well developed. In Pajbjerg it extends to approximately three-fourths of the length of the glume.

The development of the watermark is a strictly varietal characteristic, uninfluenced by climate or soil conditions, and is, therefore, of great importance in classification. It requires, however, for its examination, the use of a good lens or of a low-power microscope.

(xii). *The Lemma.* The Lemma is larger and more symmetrical than the glume, but resembles the latter in general appearance and texture. The central nerve which corresponds to the keel of the glume is never developed except at the apex of bearded varieties where it terminates in a long awn.



(*a*) External View of Glume (Red Marvel)

1. Edge. 2. Shoulder 3. Beak. 4. Keel, Showing hollow. 5. Lateral nerve. 6. Basal hairs.

(*b*) Internal View of Glume.

1. Edge. 2. Hairs. 3. Beak. 4. Watermark. 5. Basal Hairs.

In beardless varieties this nerve ends in a beak which is longer than the beak of the glume which subtends it. There is a small but progressive increase in the beak lengths of the lemmas of fertile florets of any particular spikelet from the lower to the upper floret.

The shape of the beak is important. There are four classes :—

1.	Straight	Yeoman 2.
2.	Slightly curved	Pajbjerg, Holdfast.
3.	Strongly incurved	Squareheads Master, Ironmaster.
4.	Strongly incurved and geniculate ..	Red Marvel.

Another point of interest in connection with the lemma is the length of the neck, *i.e.*, that portion immediately below the beak. There are slight differences between varieties in this respect, but they are only apparent by comparison of varieties grown under similar conditions.

(xiii). *The Terminal Spikelet.* The terminal spikelet, which is situated on the tip of the rachis, differs from the other spikelets of the ear in several important respects. It is set in a plane at right angles to that of the other spikelets. Its various organs are symmetrical. The lower glume does not develop a keel, two lateral nerves are, however, developed, and each terminates at their tip in a tooth. The shape of these teeth, the differences in the width between them and the nature and conformation of the intervening tissue are by some workers regarded as of diagnostic value. The upper glume is variable as regards shape. Generally, the central nerve is well developed and toothed as the apex, but frequently it is the two lateral and not the central nerve which are prominent.

The development of hairs on the convex side of the terminal internode—the internode inmmediately below the terminal spikelet—should be determined. In some cases it is densely pubescent, whereas in others, *e.g.*, Pajbjerg and Fenland Wonder, it is practically glabrous. This character will help to differentiate two such closely similar varieties as Queen Wilhelmina and Fenland Wonder.

(xiv). *The Ear at Maturity.* This character is only apparent when the plants are fully ripe. It is then easy to separate wheat varieties into two classes, *viz.*, those which hold the ears erect and those whose ears bend downwards. The erect stand is generally characteristic of short stiff-strawed varieties.

(xv). *The Grain.* Several characters of the wheat berry are much influenced by the soil, by the climatic conditions during growth and ripening, by the incidence of disease, by the time of cutting and by the weather experienced during the saving of the crop. Variations in regard to size, shape, plumpness, and the physical condition of the endosperm of the grain are directly due to these influences. On the other hand, three characters are relatively independent

of the environmental conditions, and it is on these that reliance must be placed in varietal identification.

(*a*) *Colour.* Wheatgrain can, in respect of colour, be divided into two distinct classes, red and white. There are several grades of red, depending on the constitution of the variety in regard to genetic colour factors, but as there is no clear distinction between them, and as, moreover, their expression is influenced by the degree of translucence of the grain, they must for practical purposes be all included in one class. The difference between red and white grain is generally clear-cut, but it must be remembered that the full development of the opaque white colour, so characteristic of good samples of Queen Wilhelmina and Juliana, only takes place when the grain develops slowly and without interruption from flowering to full maturity. Under other conditions the texture of the grain may be flinty, and the colour may, at the first glance, appear to be reddish, but experience with wheats will enable one to distinguish easily translucent red from translucent white-grained varieties.

(*b*) *Length.* The length of the grain is a steady character. Even in grain samples which are badly developed owing to attacks of "leaf blotch," the characteristic grain length of any particular floret remains relatively constant. There is, however, a normal variation in the lengths of the grain from the upper to the lower florets of the same spikelet and between the upper and lower spikelets of the same ear. In assessing this character, the lowest grains from the central spikelets, or, in the case of threshed samples, the longest grains should be taken. In this way it will be possible to separate wheats into *two classes*, long- and short-grained varieties.

(*c*) *Quality.* Although the physical condition of the wheat endosperm may be markedly affected by the environment, there is far less variation in its quality for milling and baking purposes. Quality is largely dependent on the amount and nature of the gluten. Varieties like Red Fife, Marquis, Reward, Yeoman and Yeoman 2 retain their high quality even under conditions widely different from those in which they were first developed. It has been stated that English-grown wheat samples containing only 10 per cent. of Yeoman or Yeoman 2 are unsuited for biscuit-making, for which a grist containing a very small percentage of gluten of poor quality is essential. Naturally, grain quality cannot be accurately determined from a casual or even a microscopic examination of the grain or its contents, but simple chemical tests to determine differences in this particular respect have recently been developed. However, under average conditions a distinction can be made between hard, translucent, flinty-grained varieties, and those which produce grains which are soft and starchy in cross-section.

It will be seen that the detailed examination of wheat varieties during all their stages of growth and development has revealed a number of differentiating characters—some very minute, indeed— which can be used for identi-

fication purposes. I would suggest that Instructors might, in the first instance, submit their type samples to the following analysis. The characters of Queen Wilhelmina are given as a guide:

Ear Characters:	QUEEN WILHELMINA:
Development of awns ..	Awnless.
Development of colour ..	White.
Development of pubescence ..	Glabrous.
Density	Dense: average internode length 3 mm. Many ears clavate.
Glume Characters:	
Shape	Short, wide at base, tapering at tip.
Keel	Slightly hollow.
Beak	Straight, short and blunt.
Shoulder	Sloping, wide.
Lateral Nerve	Not prominent, hairs over $\frac{1}{4}$-length.
Pilosity	Type 2.
Watermark	Large, covering over half length of glume.
Lemma:	
Beak	Bent inwards.
Neck	Short.
Terminal Spikelet	Oval, beaks blunted, spines on the two ridges.
Terminal Internode:	Pubescent.
Grain:	
Colour	White.
Length	Medium.
Quality	Starch.
Straw	Hollow.
Other Observations:	

Having analysed the various commercial wheat varieties in this way, Instructors can then underline the differences separating the varieties belonging to the same botanic group. Thus, for example, in the Group *Abidum*, the differences between Fenland Wonder and Wilhelmina are clearly shown in the development of the beaks, in the pubescence of the terminal internode, and in the shape of the ear.

Acknowledgment.

I have to thank my colleague, Mr. P. J. Carroll, M.Sc., for the illustrations of the external and internal organs of the glume.

MOISTURE, SALT AND CURD IN CREAMERY BUTTER

By

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In the manufacture of butter, the butter over-run obtained depends on the percentage moisture, salt and curd in the finished butter. For the efficient working of a creamery, and in order to obtain the maximum monetary return for the butter-fat received, it is necessary that the butter over-run should be as high as possible. With this object in view, the creamery buttermaker aims at getting the water content of the butter as near as possible to the legal limit of 16 per cent. without exceeding it, and the salt content as high as the consumer will tolerate. The curd content, which cannot be checked by any quick and easy method, suitable for use by the creamery buttermaker, is mainly regulated by the extent to which the butter is washed in the grain stage, and it is considered good practice to wash the butter well so as to remove the free buttermilk, and consequently, the curd associated with it, as completely as is practicable. (l.a.)

A good knowledge of the factors influencing the water and salt content of butter, as well as of the methods of sampling which will give true results, is of great importance and is indispensable for the proper control of the process of buttermaking.

It is also desirable that the buttermaker should know how to control the curd content, and understand the influence of curd content on the quality of butter so that he may be able to judge the degree to which washing butter is necessary.

The investigation reported herein has been conducted at University College Creamery, Cork, on sweet cream butter, made on a commercial scale, and is intended to help by contributing to the knowledge on (*a*) the accuracy of the commercial sampling of butter; (b) factors controlling the percentage water, salt and curd in the butter; and (*c*) how the curd content affects the score of butter on keeping.

METHODS.

The batches of cream, on being received from the auxiliaries, were cooled to 38°F, and held for about 16 hours, *i.e.*, until the following morning,

when they had usually risen to about 40°F, which was the temperature of churning. Except where it is otherwise indicated, churning was carried out in Astra and Holmberg short-barrelled combined churns, fitted with 3 sets of working rollers, and each having a total capacity of 880 gallons. The average amount of cream in each churning was about 250 gallons.

The modification of the Kohlman method (2) of determining the moisture, salt and curd, as described by Bird and Breazeale (3) was used throughout these experiments.

Moisture Test.

In heating butter over a methylated spirit burner, it is difficult to ensure that all the moisture is driven off without having a change of colour in the curdy matter. The influence of variation in the curd colour adopted as an end-point, on the composition figures is given in Table 1, the figures being the average of duplicate tests. In each trial, six tests were made on a single sample of butter, which had been prepared by the A.O.A.C. method (4), *i.e.*, by softening in a closed vessel and by mixing to a perfectly homogeneous semi-solid mass. The salt percentage figures were not affected by variation in the end-point, and are not given.

TABLE 1.

Influence of End-Point on Composition Figures.

Sample No.	End-point Colour					
	Light Golden		Medium Brown		Deep Brown	
	Moisture	Curd	Moisture	Curd	Moisture	Curd
1 ..	16.50	1.71	16.54	1.68	16.63	1.67
2 ..	15.46	1.31	15.48	1.27	15.53	1.24
3 ..	15.91	.73	15.98	.69	16.07	.66
4 ..	15.34	.83	15.38	.81	15.45	.77
5 ..	15.65	.86	15.72	.81	15.72	.79
6 ..	15.87	1.04	15.91	1.01	15.97	.98
7 ..	15.49	.73	15.54	.70	15.57	.67
8 ..	15.07	.93	15.12	.90	15.19	.86
9 ..	15.69	.74	15.75	.72	15.76	.70
10 ..	15.75	.75	15.81	.72	15.86	.69
Average ..	15.673	.963	15.723	.931	15.775	.903

The average increase in the moisture percentage figures obtained by heating to a deep brown instead of to a light golden colour, was almost .1 per cent. over half of which was accounted for by a loss on the curd percentage figures.

The end-point adopted in all the moisture determinations given later was

that at which, after the slight crackling sounds of bursting steam bubbles had ceased, the curdy matter turned a very light golden colour. Cooling was carried out in water and the cup wiped dry. In these circumstances, it was found that the Kohlman method gave the same moisture figures as the Irish method (5), where the only difference in method is that the aluminium cup and residue are allowed to cool in a dessicator. Gould (6) has also concluded that there is no appreciable difference in the results obtained when samples are cooled properly, regardless of the means of cooling.

Preparation of Samples.

In the commercial testing of Irish Creamery butter, no preparation is carried out on the sample. Table 2 sets out the differences between duplicate tests on single unprepared samples of well-worked butter as compared with the differences between duplicate tests on samples of the same butters, when prepared by the A.O.A.C. method.

TABLE 2.

Differences between Duplicates of Unprepared and Prepared Samples.

Unprepared Samples			Prepared Samples		
Moisture	Salt	Curd	Moisture	Salt	Curd
.05	.01	.02	.02	.00	.01
.06	.02	.04	.06	.01	.02
.07	.03	.00	.02	.00	.03
.05	.00	.02	.06	.01	.01
.07	.03	.01	.03	.00	.00
.07	.03	.03	.01	.00	.01
.05	.02	.00	.03	.01	.02
.02	.01	.03	.00	.01	.00
.00	.00	.01	.03	.00	.00
.03	.02	.02	.03	.01	.01
Av. .047	.017	.018	.029	.005	.011

The results obtained here agree in range of accuracy with those obtained by Newlander and Ellenberger (7) who state that when samples have been properly prepared and tested, duplicates should check within .05 per cent. moisture.

The Table shows that preparation by the A.O.A.C. method gives a more uniform sample, judging by the correlation between duplicates tests. The differences between duplicates of the unprepared samples are, however,

less than the degree of accuracy required in commercial testing. It may, therefore, be considered that a sample of well-worked butter is sufficiently uniform not to require any special treatment as preparation before testing.

Further trials, using the type of butter balance in common use in creameries, indicated that in commercial testing, duplicates tests on unprepared samples of well-worked butter should not differ by more than .1 per cent. in moisture and .05 per cent. in salt.

SAMPLING OF BUTTER.

Variation in composition may occur in butter due to local variation in the compacted portion of the butter and also to the presence of loose moisture. This is especially evident in half-worked butter, where much loose moisture is present, and makes the taking of an accurate sample difficult.

In this country, two methods of controlling the moisture in butter are employed. In one method, here called the "added-water" method, the butter is worked with draining to the half-way stage, when it is tested, and the calculated amount of water required is added, the working being then completed in a closed churn. In the other method, here called the "worked-in-water" method, the butter is worked in a closed churn to the half-way stage and tested. If the moisture is low, further working may be given in the water. The churn is then drained and working completed in the closed churn.

With either method of working, an accurate method of sampling at the half-way stage is essential for the close control of the moisture percentage figure in the worked butter. It is also desirable that the method of taking and preparing the samples should be rapid, to avoid any hold-up of the work.

The following trials were carried out to decide on a satisfactory method of sampling half-worked butter. In each trial, six samples were taken as follows: Two single samples were taken from adjacent places opposite the door-space of the churn, and tested without further preparation. Two composite samples were taken, each consisting of single samples from the left, middle, and right portions of the churn. These composite samples were prepared by the A.O.A.C. method and tested. Two trial samples were taken, each consisting of $\frac{1}{4}''$ thick slices from the left, middle and right of the churn. These slices were placed on top of each other, and cut down through with a spatula to obtain proportionate strips of each slice when weighing. Loose moisture was avoided in all sampling as much as possible. The moisture percentage figures of these samples are given in Table 3. Trials 1 to 5 are "added-water" butters, and trials 6 to 10 are "worked-in-water" butters.

Table 3.

Moisture in Samples of Half-worked Butters.

Trial No.	Single Samples		Composite Samples		Triple Samples	
	Lowest	Highest	Lowest	Highest	Lowest	Highest
1 ..	14.34	14.92	14.71	15.10	14.87	15.22
2 ..	14.04	14.63	13.86	14.38	13.76	13.81
3 ..	12.94	13.49	13.46	13.56	13.20	13.33
4 ..	14.23	14.31	14.16	14.49	14.05	14.27
5 ..	14.03	14.61	14.14	14.35	14.02	14.22
6 ..	13.65	14.38	14.18	14.23	13.86	14.02
7 ..	13.77	14.59	13.77	14.50	13.80	14.22
8 ..	13.78	14.73	13.84	14.21	13.91	14.16
9 ..	13.48	14.26	13.67	14.17	13.64	13.79
10 ..	14.44	14.64	14.41	14.81	14.37	14.62
Average ..	13.873	14.466	14.023	14.380	13.948	14.166
Av. Diff. ..	.593		.357		.218	
Com. Av. ..	14.169		14.201		14.057	

The Table shows that considerable variation exists between single samples of half-worked butter. Very good correlation is evident between the triple samples. In taking thin slices of butter in this method of sampling, drops of water are squeezed out of occasional small pockets in the butter, and are shaken from the sample. This is apparently the reason why better correlation is obtained between duplicates and why the average figures are slightly lower than in the case of composite samples.

The rapidity with which triple samples may be taken, and the absence of need of preparation, further commend this method of sampling half-worked butter.

Variation during working.

To determine if the method of controlling moisture had any influence on the uniformity of composition of butter, single samples were taken from adjacent places in front of the door space in the churn from the half-worked stage to the end of working, and tested. The "added-water" method was used in Trials 1 to 5, and the "worked-in-water" method in Trials 6 to 10. In all cases the butters at the finish of working showed no loose moisture. The differences in moisture figures between the single samples are shown in Table 4.

TABLE 4.

Differences Between Single Samples During Working.

Trial No.	Half-Worked	Further Working Revs.			
		4	8	12	16
1 ..	.41	.26	.16	.06	.02
2 ..	.39	.11	.26	.05	.04
3 ..	.14	.23	.20	.04	.03
4 ..	.56	.20	.31	.09	.02
5 ..	.45	.30	.14	.03	.02
Average ..	.390	.220	.214	.054	.026
6 ..	.86	.13	.10	.04	.02
7 ..	.77	.25	.05	.05	.00
8 ..	.32	.09	.14	.01	.04
9 ..	.81	.30	.22	.10	.04
10 ..	.66	.18	.16	.08	.02
Average ..	.684	.19	.134	.056	.024

The butters made by both methods of working are equally uniform. Late incorporation of water in the "added-water" method does not affect adversely the uniformity of butter.

In moisture control by the "worked-in-water" method, considerable differences occurred between the individual samples at the half-worked stage. In the "added-water" method, not much loose water was present in the churn at the half-worked stage, and this was reflected in the better correlation between the individual samples.

It is apparent that shortly after the half-worked stage, when the butter has been compacted into an almost continuous mass, the difference between single samples becomes small, although there is yet water in the churn which the butter continues to take up. It thus appears advisable to take a "half-worked" sample at as advanced a stage of working as possible, when local variation in the compacted butter has been much reduced.

Variation throughout a churn of worked butter.

Early investigators found considerable variation between samples of worked butter from the same churning. Lee, Hepburn and Barnhart (8) in 1909 reported variations up to 1 per cent., and Hunziker, Mills and Spitzer (9) in 1912, reported variations up to 2.94 per cent. in American creamery butter. Mortensen, Breazeale, Meyer and Michaelian (10) in 1937, have found variations of about .6 per cent. in a single churning. The uniformity of a churn of butter has been associated with the type of churn by Tuckey (11), and improvement of design has resulted in improvement in uniformity of butter. The moisture variation in a churning from the new type cubular stainless-steel churns without rollers has been found by Jensen and Hedemann (12) to be less than .1 per cent.

In order to determine the variation to be expected within a single churning under the usual creamery conditions in this country, well-worked churnings of butter, showing no loose moisture, were sampled and tested as follows.

Samples were taken from the left and right ends of the churn; from opposite the door-space; from the middle of the mass of butter; and from a position near the rollers. No preparation was given the samples which were tested for moisture, salt, and curd content. Typical results are given in Table 5.

TABLE 5.

Variation in Composition Throughout a Churn of Butter.

Trial No.	Left End	Right End	Door	Middle of Mass.	Rollers	Greatest Variation
Moisture						
1	16.67	16.41	16.62	16.56	16.57	.26
2	15.32	15.44	15.47	15.40	15.38	.15
3	15.76	15.77	15.84	15.82	15.79	.08
4	15.60	15.67	15.61	15.73	15.78	.18
5	15.82	15.72	15.69	15.78	15.80	.13
6	15.47	15.45	15.35	15.31	15.42	.16
7	14.71	14.72	14.78	14.90	14.72	.19
8	15.84	15.78	15.74	15.68	15.71	.16
9	15.54	15.58	15.68	15.61	15.50	.18
10	15.78	15.74	15.71	15.88	15.81	.17
Average ..	15.651	15.628	15.649	15.667	15.648	.166
Salt						
1	1.28	1.28	1.27	1.28	1.29	.02
2	1.34	1.28	1.30	1.28	1.29	.06
3	1.47	1.50	1.50	1.46	1.48	.04
4	1.73	1.72	1.71	1.80	1.75	.09
5	1.64	1.62	1.65	1.60	1.62	.05
6	1.31	1.33	1.32	1.36	1.34	.05
7	1.34	1.32	1.36	1.27	1.39	.12
8	1.50	1.48	1.50	1.49	1.48	.02
9	1.64	1.65	1.66	1.64	1.65	.02
10	1.65	1.67	1.72	1.70	1.72	.07
Average ..	1.490	1.485	1.499	1.488	1.501	.054
Curd						
1	1.43	1.45	1.40	1.44	1.40	.05
2	.82	.82	.86	.83	.85	.04
3	.92	.91	.93	.89	.90	.04
4	1.08	1.11	1.09	1.10	1.11	.03
5	.78	.78	.80	.79	.78	.02
6	.68	.71	.70	.72	.70	.04
7	.75	.78	.79	.77	.74	.05
8	.85	.82	.83	.84	.85	.03
9	.94	.97	.95	.93	.95	.04
10	1.11	1.13	1.12	1.09	1.10	.04
Average ...	.936	.948	.947	.940	.938	.038

It appears from the Table that variations of .02 per cent. moisture and 0.1 per cent. salt may occur within a churn of well-worked butter. These are local variations and do not seem to be associated with any particular part of the churn.

To avoid having any of the butter exceeding the maximum legal limit for moisture, it seems advisable not to attempt to adjust the water content above 15.8 per cent.

Composition of packed butter.

Considerable losses of moisture, varying from .44 to 1.18 per cent., according to the season of the year, have been found to occur in the packing of butter containing loose moisture, by Hunziker, Mills and Spitzer (9). Losses in packing, averaging 1 per cent. have been reported by Lee, Hepburn and Barnhart (8).

To check any losses which might occur in the packing of well-worked butter, single samples were taken from the third, eleventh, and nineteenth 56-lb. box of butter packed from the churnings given in Table 5, and tested for moisture. The average of these box samples was compared with the average moisture of the churn samples. Results are set out in Table 6. The moisture content of the last box packed from each churning is also given.

TABLE 6.

Variation in Moisture Content of Packed Butter.

Trial No.	3rd Box	11th Box	19th Box	Greatest Variation	Box Average	Churn Average	Last Box
1 ..	16.66	16.55	16.57	.11	16.59	16.57	16.52
2 ..	15.46	15.32	15.47	.15	15.42	15.40	15.51
3 ..	15.80	15.82	15.76	.06	15.79	15.80	15.81
4 ..	15.61	15.72	15.77	.16	15.70	15.68	15.79
5 ..	15.68	15.86	15.78	.18	15.77	15.76	15.88
6 ..	15.46	15.35	15.44	.11	15.42	15.40	15.76
7 ..	14.80	14.84	14.86	.06	14.83	14.77	14.87
8 ..	15.75	15.82	15.67	.15	15.75	15.75	15.85
9 ..	15.62	15.51	15.64	.15	15.60	15.58	15.70
10 ..	15.72	15.91	15.84	.19	15.82	15.78	15.90
Average ..	15.656	15.670	15.682	.132	15.669	15.649	15.759

It is apparent that no loss in moisture content occurs during the packing of well-worked butter which has no loose moisture. The variations in moisture between samples taken from different boxes of butter are of approximately the same amount as the variations between samples taken from different portions of the churn. When allowance is made for this variation, it is evident

that a single sample from a churn of worked butter will give the moisture percentage to be expected in any box of the packed butter, with sufficient accuracy.

The last box of butter taken from a churn tends to have the highest moisture content. This is due to the practice of giving the churn a few extra revolutions in working gear when most of the butter has been removed in order to gather the remainder of the butter in front of the rollers and thus facilitate its removal. If loose moisture is present in the churn at this stage, it is liable to be worked into the butter, as in Trial No. 6, above. With butter having a high moisture content, this may result in the last box or two of butter from the churn exceeding the legal limit.

FACTORS AFFECTING THE PERCENTAGE WATER, SALT AND CURD IN BUTTER.

Water.

Under normal creamery conditions, the percentage water in the finished butter is mainly determined by the skill of the buttermaker. The "added-water" method has, however, the following advantages over the "worked-in-water" method: the butter at the half-worked stage is more uniform, and its moisture content may therefore be more accurately determined; also, the amount of loose water remaining in the butter at the half-worked stage is less, and as this can only be allowed for, there is less scope for error in its estimation.

It is thus possible to strike the final moisture figure more accurately in the "added-water" method than in the "worked-in-water" method. Trout and Jensen (13), using the "added-water" method, claim to have obtained a moisture content of butter within .01 per cent. of the desired figure.

To ascertain the accuracy of moisture control which might be expected in practice, ten trials in each method for the desired figure of 15.5 per cent. moisture were made. Results are set out in Table 7, the differences between the desired figure and the figures obtained being given.

TABLE 7.

Accuracy of Moisture Control.

Method	Differences from desired figure										Average
Added-water ..	.18	.04	.18	.02	.21	.22	.15	.01	.16	.12	.120
Worked-in-water ..	.34	.30	.04	.28	.17	.19	.43	.22	.28	.19	.244

Results show that more accurate moisture control may be obtained in the "added-water" method.

Salt.

It is well recognised that the percentage salt in butter depends on the percentage salt added to the churn. Eckles, Keithley and Combs (14) give 3.3 lbs., Eckles, Combs and Macy (15) give approximately 3.75 lbs., and Hunziker (1b) gives 3.25 lbs. as the weight of salt per 100 lbs. fat that should be added to give 2.5 per cent. salt in butter, but they make no reference to the size of grain churned.

The loss of some of the added salt is due to its solution in the water which drains from a churn during working. It is logical to expect that the more water there is in a churn at the start of working, the more water that must be drained during working and the greater will be the loss of salt. Hunziker, Mills and Spitzer (9), and Otte (16) have shown that the moisture held by butter granules after draining depends on their size, and that the smaller the granules the more water is held.

The following experiments show the influence of the size of butter-grain churned on the proportion of the added salt going into the finished butter. Sweet cream on churning gives somewhat irregular rather than rounded aggregates of butter. Aggregates averaging 1-2 mm. in diameter were considered to be a small grain, aggregates averaging 3-4 mm. a medium grain, and aggregates averaging 5-8 mm. a large grain. In the trials, full-scale churnings of sweet cream were churned to different sizes of grain. The wash-water was drained in each case to the same extent judging by flow from the tap. The dry salt was then scattered evenly on top of the butter grains, and the butter was worked by the "worked-in-water" method. (Results are not given for the "added-water" method as it was not possible to collect the water draining from the churn during working).

The loose water in the churn at the half-worked stage was drawn off, weighed and tested for salt content. The small amount of salt remaining in the churn after removal of the butter was calculated from the salt test of hot rinse-water. The amount of salt lost in these two ways, added to the salt found in butter, was used as a check on the recovery of salt, and corresponded within 1 per cent. on the weight of salt added. Results are given in Table 8. The salt added is expressed as a percentage on the weight of butter made. As the weight of butter made varied from 1,200 to 1,500 lbs., the weight of water drained at the half-worked stage was also expressed as a percentage on the butter made, to form a better basis of comparison.

TABLE 8.
Influence of Size of Grain Churned on Salt Incorporation in Butter.

Grain Size	Percentage Salt added	Percentage Salt in Butter	Percentage of added Salt lost	Drain-water as a percentage on Butter-weight
Small ..	2.051	1.075	47.6	7.7
Medium ..	2.067	1.305	36.9	5.2
Large ..	2.116	1.835	13.3	1.3
Small ..	2.496	1.200	51.9	8.0
Medium ..	2.503	1.430	42.9	5.9
Large ..	2.500	1.750	30.0	4.3
Small ..	2.896	1.330	54.1	11.2
Medium ..	2.892	1.675	42.1	6.8
Large ..	3.029	2.210	27.0	3.6

Since the water percentages of the worked butters were approximately the same, the figures in the last column for water drained off during working, confirm that when the wash-water is drained off to the same extent, the amount of water which is left in the churn depends on the size of grain. The figures in the second-last column show that the greater this amount of water, the greater the percentage of added salt which is lost. The amount of salt incorporated in butter depends, therefore, on the size of the butter grains, as well as on the amount of salt added.

Curd.

Considerable variation is shown in the figures for curd content of butter. Average curd contents for American creamery butters of .9 per cent. for 547 samples have been reported by Lee and Barhnart (17); of 1.18 for 695 samples by Thompson, Shaw and Norton (18); of .83 for 2051 samples by Eckles, Keithley and Combs (14); and of .777 for 50 samples by Bird and Breazeale (3). Hunziker (1.c.) states that under normal conditions of operation, the curd content averages .7 to .8 per cent. Valentine (19) takes .75 per cent. as the average curd content of N.Z. creamery butter, and Arup and Van Gilmour (20) have given figures averaging about .31 per cent. for Irish creamery butter.

Size of Grain Churned.

The presence of curd in thoroughly washed sweet cream butter is due

to the inclusion of serum in the butter grains. The larger the grains, the more serum that is enclosed in them.

The following experiments show the influence of the size of butter grains on the curd content of sweet cream butter. In each trial, three 2-gallon batches of the same cream were churned in 6-gallon mechanically operated combined churns, and a small, medium and large-sized butter grain obtained. Each lot was washed until all traces of free buttermilk were removed, and was then worked in the churn in a uniform manner. The butters obtained were tested for curd. Results are given in Table 9.

TABLE 9.

Influence of Size of Grain Churned on Curd Content of Sweet-Cream Butter.

Trial No.	Size of Grain		
	Small	Medium	Large
1 ..	.41	.54	.87
2 ..	.70	.83	1.04
3 ..	.39	.49	.68
4 ..	.50	.61	.83
5 ..	.57	.65	1.04
6 ..	.50	.74	.99
7 ..	.53	.76	1.16
8 ..	.42	.63	.86
9 ..	.48	.65	.91
10 ..	.43	.69	.83
Average	.493	.659	.921

It is evident that the curd content of butter is directly influenced by the size of grain obtained.

The size of grain to which butter is churned would consequently affect the over-run obtained in butter-making, since, with the water and salt percentages kept at constant level, every .1 per cent. of additional curd retained would reduce the fat content of the butter by the same figure and increase the over-run by about .14 per cent. Calculated on the basis of the figures given in Table 9, the over-run obtained from butter churned to a large grain would be about .6 per cent. higher than that obtained from butter churned to a small grain.

In large churnings the times of run-off of both buttermilk and wash-water were shortened from 25 minutes in the case of small-grain butters to 7 minutes in the case of large-grain butters.

Solids-Not-Fat in Serum.

Since the curd content of butter is influenced by the amount of serum trapped in the grains, it is logical to expect that the curd content of butter will also be influenced by the amounts of solids-not-fat in the serum.

In each of the following trials, a rich cream was standardised with its own separated milk and water to give five creams each of 20 per cent. fat, but with serums of approximately 3, 6, 7, 8 and 9 per cent. S.N.F. contents. Three tests of each of these creams were made, 100 ml. being churned in each test in an electrically driven shaker to a medium grain. Very close control of the size of grain was possible. The grain obtained in each test was washed free of all traces of buttermilk, drained and uniformly worked and the butter obtained was tested for curd. The average curd figure for these butters from each of the creams was then made out. Results are given in Table 10, each figure thus representing the average of three tests.

TABLE 10.
Influence of S.N.F. in Serum on Curd of Butter.

Trial No.	Percentage S.N.F. in Serum				
	3	6	7	8	9
1 ..	.35	.46	.52	.57	.64
2 ..	.23	.40	.55	.62	.75
3 ..	.25	.48	.59	.65	.75
4 ..	.35	.48	.58	.68	.82
5 ..	.22	.47	.57	.64	.76
Average ..	.280	.458	.562	.632	.744

It is evident that the curd content of butter is directly influenced by the percentage S.N.F. in the serum of the cream.

The dilution of cream by rinse-water from equipment is thus a definite factor in creamery operations in reducing over-run.

Washing of Butter Grains.

In creamery practice the butter grains are washed once in a volume of water equal to the amount of buttermilk drawn off. The following trials were designed to determine how the method of washing the butter grains affects the curd content of butter.

In each trial four two-gallon batches of the same cream were churned under uniform conditions in six-gallon mechanically operated combined churns to the same size of grain; and later worked in a uniform manner. The draining and washing of the four churnings were varied as follows. In one churning in each trial, the conditions of bad draining were obtained by draining to the normal extent and then returning 10 per cent. of the buttermilk to the churn, the wash-water being then added. Another churning in each trial was washed once, and another washed twice. In the other churning, break-water to the extent of one-third of the volume of cream was added, as soon as butter grains formed, and churning was then continued until the grains reached the desired size, when the buttermilk was drawn off and the grains washed once. All the butters obtained were tested for curd content and results are given in Table 2.

TABLE 11.

Influence of Washing of Butter Grains on Curd Content of Butter.

Trial No.	Size of Grain	Treatment			
		Badly Drained	Washed Once	Washed Twice	Breakwater and Washed Once
1 ..	Small	.85	.69	.52	.30
2 ..	,,	.75	.62	.50	.28
3 ..	,,	.74	.54	.48	.28
4 ..	,,	.74	.57	.45	.29
5 ..	,,	.72	.50	.40	.26
Average ..	.. ..	.760	.584	.470	.282
6 ..	Medium	.94	.86	.74	.41
7 ..	,,	1.07	.96	.88	.56
8 ..	,,	.92	.90	.78	.45
9 ..	,,	.97	.83	.77	.58
10 ..	,,	.86	.75	.67	.44
Average ..	.. ..	.952	.860	.768	.488
11 ..	Large	1.25	1.23	1.16	.71
12 ..	,,	1.42	1.32	1.27	.76
13 ..	,,	1.30	1.21	1.18	.62
14 ..	,,	1.18	1.15	1.12	.66
15 ..	,,	1.06	.97	.91	.33
Average ..	.. ..	1.242	1.176	1.123	.616

Results show that the curd content of butter is affected by the completeness of removal of the buttermilk and by the extent of the washing of the butter grains. It is apparent, however, that the larger the butter grain the less it is affected by the washing. The addition of breakwater cuts down very considerably the curd content of all butters irrespective of the size of grain.

Score of Butter and Curd Content.

Different opinions have been expressed regarding the effect of the curd content on the score of butter.

Arup and Van Gilmour (20) noted that it is possible to find butters with high curd percentages which keep well, but that in general, butters with high do not keep as well as those with low curd percentages. In their investigations, however, the highest curd percentages in the trials were only about .5 per cent. They also noted that butters with the higher curd content scored higher when fresh but showed a greater fall in six month's storage. Wyant (21) also working with butters of a low range of curd contents, considered that curd content did not affect the score of butter, but that the keeping quality of washed butter was somewhat better than that of unwashed butter. Jensen (22) found that it was possible to increase the curd content of butter from .9 to 1.5 per cent. without affecting keeping quality. Results of the Danish Experimental Station (23) and (24) using stainless steel churns and special working conditions indicated that butter had the better quality when not washed at all. Commenting on these results, Hunziker (1 d.) observed that they had a background of minimum bacterial contamination, and of separation of bacteria from food supply by the emulsification of the moisture present to an exceedingly small size of droplets, as well as other factors.

In the following experiments, large churnings of properly pasteurised creams in good condition were made. In each trial, butter was removed from the churn at different stages of the grain growth, so as to obtain small, medium and large grains from the same churning. The grains were washed free of all traces of buttermilk and were then worked as uniformly as possible, until close-textured butter with no loose moisture was obtained. It was noticeable at this stage that the larger grain butters had a distinctly finer flavour and aroma than the smaller grain butters. Batches of butters thus obtained were held at particular temperatures for suitable periods and were then scored for flavour and aroma and tested for curd content. Results are given in Table 12. The maximum possible score for flavour and aroma was 60.

TABLE 12.

Influence of Curd Content of Butter on Score after Storage.

Conditions of Storage	Trial No.	Small Grain		Medium Grain		Large Grain	
		% Curd	Score	% Curd	Score	% Curd	Score
Temp. of holding..45°-50°F.	1	.34	54	.42	54	.47	54
	2	.35	53	.37	53	.53	54
	3	.49	54	.64	54	.64	55
	4	.43	56	.63	56	.65	57
	5	.41	52	.48	52	.51	53.5
	6	.47	56	.54	56	.68	57
Time of holding..7-9 weeks	7	.42	55	.53	55	.65	56
	8	.57	53	.63	53	.72	54
	9	.45	53	.57	54.5	.70	54
	10	.49	54	.60	55	.66	55
Average		.442	54.00	.541	54.25	.621	54.95
Temp. of holding..55-60°F.	11	.38	55	.60	56	.78	55
	12	.41	54	.65	55	.88	56
Time of holding ..6-8 weeks	13	.35	54	.58	54	.84	55
	14	.33	56	.64	56	.81	56
	15	.40	54	.66	53	.97	54
	16	.37	55	.56	55	.74	55.5
	17	.28	56	.46	56	.62	56
	18	.36	55	.57	56	.93	57
	19	.30	55	.51	54	.75	54.5
	20	.39	56	.66	56	.93	57
Average		.357	55.00	.589	55.10	.825	55.60
Temp. of holding..65°-70°F.	21	.41	55.5	.65	55.5	.92	55.5
	22	.35	55	.52	55	.62	55
Time of holding..3-4 weeks	23	.38	52	.50	52	.71	54
	24	.34	54	.43	54	.60	53
	25	.33	57	.55	57	.81	57
	26	.38	57	.61	57	.85	57
	27	.31	56	.50	56	.69	55.5
	28	.43	55	.59	55	.87	55.5
	29	.32	56	.62	55	.78	56
	30	.42	56	.66	57	.93	56
Average		.367	55.35	.563	55.35	.778	55.45

The above results indicate that large grain butters with a high curd content scored better for flavour and aroma after holding than small grain butters with a lower curd content. There appears to be a tendency for the difference in score to become less as the holding temperature of the butter is increased.

To determine the influence of curd content on the flavour and aroma of cold-stored butter, the following experiments were carried out. Thirty large-scale churnings of properly pasteurised creams in good condition were made, giving on an average about 1,400 lbs. of butter each. Ten small-grain, ten medium-grain, and ten large-grain butters were selected. All other

experimental conditions were uniform and the butters obtained were close-textured with no loose moisture. It was again noticeable that when freshly churned, the larger-grain butters had a distinctly finer flavour and aroma than the smaller-grain butters. All lots of butter were cold-stored for twenty to twenty-three weeks at 10°F.

When the butter was taken out of cold store it was thawed out in the packages for about three days and then made up in lb. bricks for sale. One pound was taken from each churning and held at laboratory temperature for two weeks and then scored for flavour and aroma. The holding period in the laboratory would represent the maximum time the butter would likely be held after leaving the creamery and before being consumed. The laboratory temperature was, perhaps, higher than the temperature at which butter is usually held, even in the household, and this would explain why the scores given are low. Results are set out in Table 13.

TABLE 13.

Influence of Curd Content on Score of Cold-Stored Butter.

	Small-Grain		Medium-Grain		Large-Grain	
	% Curd	Score	% Curd	Score	% Curd	Score
	.60	55.5	.83	55	.95	56
	.67	57	.73	56	.94	57
	.63	56	.77	57	.93	56
	.54	54	.76	55	.96	55
	.58	56	.73	53.5	.98	57
	.62	55	.85	55.5	.92	55.5
	.60	56	.70	57	1.12	56
	.54	56	.75	56	.99	56
	.45	54	.72	55	1.01	55.5
	.68	54	.75	56	1.00	56
Average	.591	55.35	.759	55.6	.98	56.0

These results indicate that large-grain butters with high curd content will have a better flavour and aroma after long-term cold storage than small-grain butters with lower curd content.

It must be again emphasised, however, that all the results obtained in this section were obtained on butters made from properly pasteurised creams in good condition.

SUMMARY.

1. In the commercial testing of butter for moisture content, no special preparation of samples before testing is necessary in the case of well-worked butter.

2. When butter is sampled and tested at the "half-worked" stage as a guide to the control of moisture content, the less loose moisture in the butter at that stage the more reliable the test and the closer the control that can be exercised over the final moisture content.

3. A quick method for taking a representative sample of "half-worked" butter is indicated.

4. The limits of variation in moisture and salt content in any churn of well-worked butter were found to be about 0.2 and 0.1 per cent. respectively.

5. When butter has its moisture well incorporated there is no loss of moisture during packing.

6. The "added-water" method of controlling the moisture content of butter was found more accurate than the "worked-in-water" method.

7. The size of the butter grains at salting was found to be an important factor in determining the proportion of the added salt that is retained in the butter. Large butter grains have good retention capacity and small butter grains poor retention capacity.

8. Irrespective of the extent of washing and draining, the size of the butter grains is an important factor regulating the amount of curd retained in butter, as is also the percentage of solids-not-fat in the serum of the cream.

9. It has been found that large-grain butter, made from cream that had been properly pasteurised, is usually better in flavour and aroma after a period of storage than small-grain butter, notwithstanding the higher curd content of the former.

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TREES ON THE FARM.

By

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Well-placed trees of the right kinds are an addition to any farm. They enhance its appearance, they provide shelter from wind and driving rain and produce welcome fuel for the house and timber for many farm purposes when the time arrives for thinning or for felling those which have grown too large for their positions. Farmers have a prejudice against old spreading trees. This objection is sound as such trees impede tillage operations with their far-flung roots and damage grass and crops by excessive shading, and their felling is often desirable in the interests of agriculture. It is equally desirable, however, to plant anew if the farm is to be saved a bleak and desolate aspect and an important part of its productive capacity retained. Young trees occupy little room. Their roots and branches present no problem and until they reach maturity in years to come there is no objection to them, but on the other hand they benefit the farm in many ways.

KINDS OF TREES SUITED TO IRISH CONDITIONS.

Conifers. The Irish planter is lucky in having a long list of trees to choose from. The Scots Pine is a favourite amongst the conifers. It grows well on most soils of a dry nature provided the situation is not fully exposed to constant wind. The timber, the popular Red Deal, is one of the best for all construction work. The Austrian and Corsican Pines produce soft, coarse-grained and knotty wood but they are valuable shelter trees and make good wind breaks on the bleakest sites with a fairly fertile and dry soil. The Corsican does not take kindly to moving and even when planting is done with special care losses are usual. This weakness is shared by *Pinus Insignis*, a fast-growing Californian Pine which is an excellent shelter tree but a poor timber producer. A pair of hardy pines, fitted for the worst soils and situations are *Pinus contorta* from America and the European Mountain Pine. They will thrive where no other tree can exist and, considering everything, will grow into useful poles. Another branch of the conifer tribe of interest to farmers is the Spruce, of which the Sitka and Norway Spruces are the most outstanding. The American Sitka is the faster grower and better wind resister but the Norway is hardier in low-lying damp places where ground frost tends to lie. They both need plenty of moisture, but not stagnant water, and given that, are not particular whether the soil is a heavy clay or a shallow peat. The well-known White Deal is the wood of spruce and it is good for floors and partitions and many

other indoor uses. The outstanding disability of these trees is their shallow system of roots which leaves them liable to wind-throw in heavy gales, the Norway being, perhaps, worse in this respect than the Sitka. Another valuable conifer is the Larch. The European species needs a fresh and fertile soil to grow to its full size but even in a poor place it will make a sizeable tree and be useful for rails and fence posts in little more than a dozen years. The Japanese species is less fastidious about soil and stands wind better, but has a softer and less durable timber. Other conifers which may be considered are Douglas Fir, Silver Fir, Cypress and Thuja. The Californian Cypress, *Cupressus macrocarpa*, is popular everywhere as a hedge plant and shelter tree. Once established it grows quickly and furnishes a good screen in a few years. The Lawson Cypress and the closely related *Thuja plicata* are also excellent shelter trees and do well on soils ranging from moist peat to dry limy gravel. Douglas Fir is a more rapid grower than the Silver Fir but it needs a deep lime-free soil, somewhat dry, and a situation sheltered from wind, so that it is ruled out for many parts of the country and the planter must turn to the Silvers, either the European or the American, if he wishes to plant firs.

Broadleaves. Unlike the conifers of which the larch is the only common deciduous one, the broadleaved trees nearly all shed their leaves in autumn. Three exceptions are the Tree Holly, the slow-growing Ile or Holm Oak and the Australian Eucalyptus. The Common Oak, the Beech, the Ash, the Poplar and the Willow are met with everywhere. The Oak needs a deep, heavy and rich soil, the Beech and the Ash thrive on fertile loam of a limy nature and the Poplar and Willow do best on fresh soils near running water. All these species are suited to farm planting if not permitted to grow too large. Ash, it is true, is not in favour with ploughmen because of its spreading surface roots, but when the many uses of its wood, for handles, shafts, swings and wheels and its virtues as a brightly blazing fuel, are remembered it can be forgiven much. Others, at home on the lighter soils, are Birch, Sycamore, Maple and Sweet Chestnut, all handsome trees which lend variety to the landscape and produce timber in demand for many purposes.

PLANTING FOR SHELTER.

The comfort of a well-sheltered farmsteading is realized by all. Shelter means a warm home, warm byres and stables, agreeable conditions for winter yard work and freedom from trying winds during threshings and when handling hay and straw in stormy weather. Where at all possible every farm house and haggard should have substantial screens on the north, north-east and western sides to ward off the coldest as well as the most constant winds. Shelter belts on the exposed margins of bleak fields are also very desirable and are a comfort to men at work and a benefit to wintering cattle and sheep.

Windbreaks, to be effective, should be composed mainly of evergreen species. It is better, however, that they should not consist entirely of such species. Besides varying the sombre aspect of a mass of dark evergreens, deciduous trees such as oak, beech, sycamore and birch keep a wood healthy and lessen danger of overthrow by wind.

A good plantation on dry ground fully exposed to wind might comprise Austrian, Corsican and Insignis Pines with Japanese Larch, Sycamore and Beech through them. On less windswept sites Scots Pine could be substituted for the Austrian and Corsican and *Cupressus macrocarpa* put in so that the screen might remain dense close to the ground when the lower branches of the pine die off. On good damp soils and on fully exposed situations Sitka Spruce is unexcelled in rapidity of growth and effectiveness as shelter. It is well to have other damp-loving trees such as oak and alder in groups here and there through it. For poor ground, either rocky or peaty, *Pinus contorta* and Mountain Pine should be the choice with a few clumps of Birch. Norway Spruce will do well on wet and Douglas Fir on dry soils as long as the prevailing winds do not blow directly on the site. Oak and Alder in groups may be added to the Spruce and Japanese Larch either singly or in groups to the Douglas Fir plantations. Another good mixture is Lawson Cypress and *Thuja plicata* on almost any soils and in fully exposed positions.

The depth of shelter belts depends to a great extent on the amount of ground which can be spared to them. About six rows 5 or 6 feet apart make a good belt, but two or three or even a single row of vigorous trees will give a surprising amount of shelter.

PLANTING FOR TIMBER.

A piece of cleared woodland or rough ground of little agricultural value can be turned to profitable account when planted with species that will yield poles and timber for farm use. There can be no question that such planting is well worth while. A farmer with his own trees is in the happy position of being independent of costly purchased boards and posts every time he wants to make a gate or repair a fence. His home-produced wood is worth full retail price to him and is on the spot when it is needed. The time from planting until first felling is not so great either. Well chosen and well planted stock will be yielding usable thinnings in fifteen years and thereafter thinnings can be made at intervals, cutting out trees encroaching on neighbours, and it is not long until poles large enough to saw into boards can be obtained.

Profitable species for dry and sheltered ground are Scots Pine and European Larch, 4 to 5 feet apart in mixture, with an occasional Beech. If the soil

is a dry peat, plant Scots Pine. On a fresh and fertile slope there is no more remunerative tree than European Larch by itself or with a small proportion of Scots Pine and Beech. Japanese Larch often gives good results on craggy land or on soils too sour to suit the European species. Wet, but not waterlogged ground, clayey or slightly peaty, will grow Sitka or Norway Spruce. If water tends to lie, shallow, open drains are a first necessity, and if the soil is sour, sods cut from the drains may be laid out 5 feet apart, grassy side down and used as planting sites. Such "mounds" should be firmly placed on the ground and should be 15 inches or so square and 9 inches thick.

A well cared plantation can yield remarkable returns. A statute acre of Scots Pine may in fifty years produce close on 140 tons of timber. After the twenty-fifth year approximately 1 ton of timber can be cut each year as thinnings, and at the end of the fifty years there will be over 100 tons still on the ground. Larch gives good-sized poles in fifteen years and from then onwards twenty or thirty trees, weighing in all one to almost two tons, can be thinned from an acre each year, leaving 150 tons still to be harvested at fifty years of age. The yield of Spruce under favourable conditions is even more striking. Norway Spruce can give an annual increment of 6 tons per acre over fifty years, producing as much as 3 tons yearly in thinnings after twenty-five years growth and having a standing crop of 225 tons at fifty years.

It need not be stressed that this production of timber is a considerable asset to a farmer. Even a small plantation can keep him supplied with all his needs for fencing and building. The outlay on conversion into boards and scantlings is small as he uses his own men and horses for felling and haulage to the sawbench during slack times. When well grown and well seasoned, Irish timber has no rival for strength and durability, and it is a paying proposition for landowners, both large and small, to lay down some of their less useful land to this valuable crop.

TREES FOR ORNAMENT.

Ornamental planting may seem out of place on a farm, but there are few farms without spare corners about the yard or garden which, when bare, are an eyesore, but which could well grow a few flowering or brilliantly-foliaged trees. Such trees would brighten the surroundings in which the farmer and his family spend so much of their lives and would be appreciated at all seasons. Of ornamental trees, cherries must be placed first for the beauty of their flowers, the warm tints of their leaves in autumn and the grace of their branching. They like a good loam, dry and limy, but will do on practically all soils. Some varieties of Cherry bloom in winter and spring, when other flowers are scarce, and one or two of the choice ones are worth having in a garden. Two may be mentioned, *Prunus subhirtella autumnalis,*

which flowers between November and March and *Prunus yedoensis*, which follows it into the month of April. Closely allied to the Cherries are the Almonds and the pink-flowering Almond, *Prunus amygdalus*, which blooms in March, is one of the best.

Less choice flowering trees are the Common Wild Cherry, the Wild Crab Apple, the Hawthorn and the Horse Chestnut, both pink and white. For foliage there are the Copper Beech in all shades from light bronze to dark purple, the silvery leaved Whitebeam and the steel-grey Atlantic Cedar. Avenues and private roads can be made attractive by the planting of standard Silver Birch, Lime, Lombardy Poplar or Mountain Ash along the verges or on the ditch.

AGES AND SIZES OF PLANTING STOCK.

About four years of age and twelve inches to twenty-four inches in height are proper for young trees going into plantations or shelter belts. The essential condition is that they should be *transplants*, having been moved once or twice to fresh ground during their years in the nursery and that they should have a good ball of fibrous roots and a stocky stem well furnished with living branches. Pines and Larches are better on the small side, Spruces may be up to twenty-four inches with safety. Other conifers and the broadleaves may exceed twenty-four inches, but generally speaking small plants of all sorts are best, provided they are kept free from encroaching weeds and grass during the first years. Single trees on lawns and in gardens, avenues and hedgerows are usually planted as standards when five or six feet high. They are specially treated in the nursery and correspondingly expensive but give quicker results and are more easily protected from injury than would small plants in such positions.

SEASON AND METHOD OF PLANTING.

Planting can safely be done in most cases during open weather between November and March. Larch should be got in before the end of February and some poor transplanters such as *Pinus Insignis* and *Cupressus macrocarpa* do best if moved before root growth ceases in October, or after it starts in April. When the bales of trees arrive from the nursery they should be opened immediately and the plants heeled-in in shallow trenches with the soil well packed around the roots to exclude air and frost. Here they remain until the planting starts when they are brought out in small lots and promptly got into the ground before sun and wind have had time to dry out the roots. Preparation of the ground before planting need not be elaborate. Rank grass and briars should be cut and burned, but there is no need to interfere with shoots and suckers and other small trees or shrubs, neither is there reason

to grub up old stumps. Surplus water should be run off by open drains and existing drains and ditches cleaned and when the soil is peaty or otherwise sour and retentive, mounds may be made of the sods and soil dug out of the drains. Rocky patches can be improved by opening pits with a pick and filling up with a bucketful or so of good soil. For planting, open a pit large enough to take the roots without cramping, gradually fill in the pulverised soil and firm with the foot. During the filling move the tree up and down a few times to allow the soil to settle between the finer rootlets. It is most important not to set the tree too deeply. The correct depth is shown by the soil mark where it stood in the nursery.

PROTECTION OF YOUNG TREES.

This is a problem on the average farm. Horses, cattle, sheep and goats have all a taste for succulent twigs and bark and will do severe damage unless fenced off. A stout fence is needed, four feet high, constructed of posts and rails or posts and barbed and woven wire. An advantage of hedge-row planting is that trees can sometimes be placed in amongst the thorns and out of reach of grazing animals. Single trees can be protected by a guard made with three or four corner posts and rails and barbed wire. If rabbits are numerous a netting fence will be needed, the netting standing three feet above the ground with a six inch flap below, turned outwards along a shallow trench and held by sods.

AFTER-CARE OF TREES.

During the first few years all tall vegetation threatening to smother the trees should be cut back once or twice each summer. Broadleaves need a light pruning, cutting out double leaders and coarse side branches so that the trees may develop clean straight boles. Standards which have been tied to stakes to prevent swaying in the wind should have the ties examined occasionally in case they are cutting into the bark. Blanks caused by failures should be filled in the first and second winters with the same species, or with a different one if it is apparent that a mistake has been made in the selection.

THINNING OF BELTS AND PLANTATIONS.

When the lower branches of the trees to a height of five or six feet have been suppressed it is time for the first thinning. First, the dead branches should be trimmed off neatly with a handsaw and all dead and dying trees cut down. Then, over-crowded patches should have a few of the poorer stems removed to let in light and air to the remainder. A sign of need for thinning is drawn up and weak swaying stems and a small crown of green branches. A healthy tree with sufficient growing space should have a stout

and steady stem and a crown of living branches reaching down one-third of the total height of the tree. A safe rule is to thin little and often and never to make a big gap which may result in wind throw. Under-thinning leads to tall thin stems and poor health ; over-thinning results in coarse branchy trees of poor timber value and in a host of weeds and briars forming a dense undergrowth which checks tree growth and is a hindrance to work. Well thinned belts and plantation have vigorous sturdy trees with dense well developed crowns and a clean weed-free soil surface.

TRIALS ON THE RESEEDING OF PASTURES AT THE DEPARTMENT'S FARMS

Considerable prominence has been given in agricultural literature in recent years to the advantages to be derived from direct reseeding with grass seeds of poor and worn out pastures. The procedure generally recommended is the ploughing up of the old pasture in early spring or in July or August, the preparation of a fine seed bed and reseeding with a suitable mixture of grass and clover seeds together with an application of artificial manures, particularly phosphates, and lime where necessary. This system has been advised in circumstances where it was inconvenient or undesirable to put the land in question through a rotation of cropping and particularly has it been recommended for land of low fertility and on which under normal conditions the growing of tillage crops would be of doubtful economy.

With the object of comparing pastures obtained by direct reseeding with existing pastures, trials were carried out at the Department's Agricultural Schools at Athenry, Ballyhaise and Clonakilty during the seasons 1940 to 1943 and the following is a brief report on these trials.

ATHENRY CENTRE.

A field of approximately nine acres with a southern aspect and which had been in pasture for close on a century was divided into two plots. The soil varied from an alluvial clay along a river bank to a light sharp drift soil overlying limestone on a hill at the other end. A plantation at the river end of each plot afforded shade for stock in hot weather. The pasture was of moderate quality and had been dressed in 1937 with 3 cwt. semsol per acre and for years had been grazed with mixed stock consisting mainly of cows and their calves and occasionally with sheep.

The whole field was grazed till 15th April, 1940, when one plot was shut up and the other ploughed for reseeding to a depth of about four inches. Subsequent preparation of this plot consisted of heavy rolling, discing and harrowing. Sowing of the seeds was unavoidably delayed till 14th May. The following seed mixture was sown at the rate of 33 lb. per statute acre :—

	lb.
Italian Rye Grass	10
Perennial	16
Cocksfoot	7
Timothy	4
Rough-stalked Meadow Grass	1
Broad Red Clover	2
Late-flowering Red Clover	2
Wild White Clover	1

Semsol was applied at the rate of 2 cwt. per statute acre to both plots at the time the seeds were being sown. The braird on the reseeded plot was good but growth was slow in June due to drought. Moist conditions in late June and early July brought on rapid growth and grazing commenced on 26th July. The plot was stocked with four bullocks and ten wethers. Four extra bullocks were added on August 2nd and the plot supported this stock until September.

By early July the old pasture plot had reached such an advanced stage that it was considered better to cut it for hay and postpone commencing comparison of the grazing capacities of the two plots till the following season. This plot, therefore, was mown on 5th and cocked on 11th July, the yield of hay being 22 cwt. per acre.

Subsequently both plots were grazed in common till 1st February, 1941, when they were closed up to allow the pasture to recover. During this autumn and winter period the herbage on the reseeded plot was more plentiful and fresher than on the old pasture plot.

1941 SEASON

From 1st February onward, growth on the reseeded plot was very rapid and the grass was well advanced by 22nd April, on which date both plots were restocked. Six $2\frac{1}{2}$-year-old to 3-year-old bullocks were put to graze on the reseeded plot and four on the old pasture plot which at this date was less advanced. On 1st May two more bullocks were added to the reseeded and one to the old pasture plot.

Growth of grass on the reseeded plot was so vigorous up to end of June that as a result of the heavy stocking necessary to keep it grazed a good deal of fouling of grass occurred and it was afterwards felt that it would have been better to have commenced grazing this plot about 10th April.

The plots were grazed in three periods as follows :

Period (1) 22nd April till 6th June.
Period (2) 16th June till 1st August.
Period (3) 1st September till 17th September.

During the intervals between these periods the cattle were grazed on common pasture the same animals being returned to each plot at the beginning of each period.

The cattle were weighed at the beginning and end of each grazing period. The procedure at weighing was as follows :—The cattle were brought into the yard at mid-day and weighed, fed a small allowance of hay only and

weighed the following day at mid-day and the average of the two weighings taken. In the following tables the number of cattle-grazing days given in each case is the total number of days grazed multiplied by the number of the particular type of cattle used.

Table I gives the numbers of animals and average initial and final live weights for each period on each plot.

TABLE I.

Number of Animals and Average Initial and Final Live Weights.

Period	Reseeded Plot			Old Pasture Plot		
	Number of Bullocks	Initial Live Weight	Final Live Weight	Number of Bullocks	Initial Live Weight	Final Live Weight
		c. qr. lb.	c. qr. lb.		c. qr. lb.	c. qr. lb.
21 April—6 June ..	6	6 3 15	8 2 17	4	6 3 5	8 0 20
	*2	7 0 21		*1	7 0 0	
16 June—1 Aug. ..	8	9 0 19	9 3 0	5	8 3 0	9 2 3
1—17 September..	8	9 3 17	10 1 3	5	10 0 0	10 1 8

*Added 2nd May.

The following are the number of cattle-grazing days and the total live weight increase per statute acre for each of the plots :

	Cattle-grazing Days	*Live Weight Increase*
Reseeded Plot	215	5.3 cwt.
Old Pasture Plot	108	2.4 cwt.

Five of the eight cattle on the reseeded pasture and three of the five on the old pasture were prime beef at 17th September, when the stock was removed from the plots. The remainder of the animals were in good to moderate condition.

While the aim throughout the grazing season had been to graze both plots to the best advantage the reseeded plot at the end of the season was eaten quite bare while there was a reasonable amount of keep on the old pasture plot.

The following is the botanical composition of the two plots on 4th June, 1941.

	Old Pasture	*Reseeded Plot*
	%	%
Perennial Ryegrass	2.7	35.0
Italian Ryegrass	—	1.3
Cocksfoot	—	37.0
Timothy	—	13.0
Rough-stalked Meadow Grass ..	—	3.6
Crested Dogstail	14.0	—
Red Fescue	18.0	—
Yorkshire Fog	4.9	—
Sweet Vernal	2.1	—
Sheep's Fescue	9.9	—
Bent Grass	3.5	—
Red Clover	2.8	3.4
Wild White Clover	0.7	2.6
Plantain	22.5	—
Dandelion	3.6	—
Daisies	15.0	—
Crowfoot	—	1.2

1942 SEASON.

During the winter of 1941–42 and the spring of 1942 the plots were grazed in common with cattle and sheep at various times till about mid-April when they were cleared to allow the grass to develop. During this period the stock had shown a decided preference for the reseeded plot due, no doubt, to its earlier growth and consequent superior palatability. As a result this plot was eaten very bare and suffered rather severely from a prolonged drought in the early summer.

On 25th May the reseeded plot, which was the more advanced, was stocked with six 2½-year-old bullocks and the old pasture plot with four bullocks of comparable quality. All the animals were weighed before being put out on the plots.

At the end of three weeks the reseeded plot had become rather bare. Accordingly, on 15th June, the bullocks were weighed and those from the reseeded plot put to graze on the old pasture plot and *vice versa.* On 27th July they were re-weighed and again changed about. On 17th August the cattle were removed off both plots which were closed up till the end of September. At the time the cattle were removed the reseeded plot was eaten bare and the old pasture plot, though not quite so bare, was well grazed down.

On the 28th September two further lots of four bullocks each were put on the plots. On 12th October they were alternated and on 26th October were finally removed from the plots.

Table II gives the average initial and final live weights of each lot for each period on each plot.

TABLE II.

Average Initial and Final Live Weights for each Period on each Plot.

Period	Reseeded Plot			Old Pasture Plot		
	Number of Bullocks	Initial Live Weight	Final Live Weight	Number of Bullocks	Initial Live Weight	Final Live Weight
	First Lot	c. qr. lb.	c. qr. lb.	*First Lot*	c. qr. lb.	c. qr. lb.
25 May—15 June	6	8 1 23	9 0 18	4	8 1 24	9 1 16
15 June—27 July	4	9 1 16	9 3 25	6	9 0 18	10 0 5
27 July—17 Aug.	6	10 0 5	10 0 16	4	9 3 25	10 1 19
	Second Lot			*Second Lot*		
28 Sept.—12 Oct.	4	10 3 25	11 1 5	4	10 3 14	11 0 25
12 Oct.—26 Oct.	4	11 0 25	11 0 4	4	11 1 5	11 0 25

The following are the number of cattle-grazing days and the live weight increase per statute acre for each plot during the season 1942 :—

	Cattle-grazing Days	*Live Weight Increase*
Reseeded Plot	133	1.92 cwt.
Old Pasture Plot	106	2.33 cwt.

When the cattle were finally removed from the plots there was still a fair amount of keep on both. The sole on the old pasture plot was the more dense and it contained a considerable amount of moss and small weeds. The reseeded plot was still practically free from moss but weeds appeared to be establishing themselves gradually. Cocksfoot was growing strongly and bare patches were evident in the sward.

1943 SEASON.

Both plots remained unstocked over the winter and spring and were in good condition for grazing early in May. The reseeded plot was the more advanced, perennial ryegrass and cocksfoot being particularly in evidence. The old pasture plot, however, was the more dense and contained a fairly

high proportion of weeds such as plantain and moss. At this stage the reseeded plot also contained a fair proportion of weeds and reversion became more marked as the season advanced.

On 10th May two comparable lots, each consisting of four two-year-old bullocks, were put to graze on the plots and during the subsequent grazing season were alternated at three-weekly periods. At the end of May both plots appeared capable of carrying further stock and on 31st May one further bullock was added to each plot.

Early in July the thistle cutter was run over both plots to cut thistles and flowering stems of grass. At this stage the sward on the old pasture plot was dense but short while on the reseeded plot there was a less dense but vigorous growth of perennial ryegrass, cocksfoot and bent, which tended to run to seed. In order to prevent this and to graze the plot closely four extra bullocks were put on the plot on 26th July. When the animals were being weighed on 23rd August it was found that they had put on very little weight for the period. Accordingly the four extra bullocks were removed and the mower run over the plot to cut flowering stems. The plot had now become very patchy, parts of it having been grazed severely, while other parts had been almost entirely avoided, the cocksfoot was strongly bunched and bent was much in evidence.

During the course of the experiment one animal developed timber tongue and was removed from the experiment from 2nd till 9th August. Immediately prior to 2nd August this animal had been on the reseeded plot and had lost considerably in weight. A correction for this is made in the results.

The experiment was concluded on 13th September. At this date both plots had been severely grazed and required a rest. The sward on the reseeded plot had become very open and contained a high proportion of such grasses as bent, sheep's fescue and crested dogstail as well as a substantial proportion of such weeds as plantain, daisies and crowfoot. The old pasture carried a much closer sward and while the less desirable grasses as well as a proportion of weeds and moss were present its appearance was better than that of the reseeded plot. Later in the season when the plots were grazed in common, the cattle showed a decided preference for the old pasture plot while the quality of the reseeded plot appeared to deteriorate rapidly.

Table III gives the initial and final weight of the cattle (excluding the four animals added to the reseeded plot on 25th July) at the beginning and end of each three-weekly grazing period on each plot.

TABLE III.

Initial and Final Average Live Weights for each Period on each Plot.

Period	Reseeded Plot			Old Pasture Plot		
	Number of Bullocks	Initial Live Weight	Final Live Weight	Number of Bullocks	Initial Live Weight	Final Live Weight
		c. qr. lb.	c. qr. lb.		c. qr. lb.	c. qr. lb.
10 May—31 May	4	7 2 26	8 2 17	4	7 2 26	8 3 27
31 May—21 June	5	8 3 18	9 1 24	5	8 2 14	9 0 6
21 June—12 July	5	9 0 6	9 1 13	5	9 1 25	9 3 0
12 July—2 Aug.	5	9 3 22	9 3 22	5	9 1 13	9 2 13
2 Aug.—23 Aug.	5	9 2 13	9 2 27	5	9 3 0	10 1 14
23 Aug.—13 Sept.	5	10 1 19	10 2 7	5	9 2 27	10 0 11

The four extra bullocks grazed on the reseeded plot from 26th July till 23rd August lost a total of 21 lb. for the period.

The following are the number of cattle-grazing days and the live weight increase per statute acre for each plot.:

	Cattle-grazing Days	*Live Weight increase*
Reseeded Plot	180	2.59 cwt.
Old Pasture Plot	122	2.97 cwt.

Thus the reseeded plot provided a greater number of cattle-grazing days but a lesser live weight increase per acre than the old pasture plot.

In each of the three seasons of the experiment the reseeded plot provided the greater number of grazing days but only in the first season did it give a higher live weight increase than the old pasture plot.

BALLYHAISE CENTRE.

1941 SEASON.

A ten-acre pasture field, with a northerly aspect, never before under tillage, of rather shallow stony loam on a retentive clay subsoil was divided into two equal plots, one of which was ploughed to a depth of 4½ inches during March. Pressure of other farm work and a severe drought in April delayed sowing of the seeds till mid-May, when rain fell. The plot was seeded

on 14th May with the following mixture at the rate of about 50 lb. per statute acre, the heavy seeding being to compensate for low germination of the rye grasses :

	lb.
Perennial Rye Grass	16
Italian Rye Grass	14
Meadow Fescue	4
Cocksfoot	6
Timothy	3
Late Flowering Red Clover ..	3
Alsike Clover	2
White Clover	1
Wild White Clover	½

Each plot was given a dressing of superphosphate at the rate of 3 cwt. per statute acre in April.

The old pasture plot was stocked on 28th May with seventeen bullocks 2 to 2½-years-old. On 16th June these were moved on to other pasture and returned to the plot on 29th July where they remained till 12th August. From 1st till 29th September the plot was stocked with nineteen heifers, 1 and 1½-year-olds. The reseeded plot was stocked on 15th July with seventeen 2 to 2½-years-old bullocks which were replaced on 16th August by twenty 1 to 1½-year-old heifers. These latter scoured rather severely and the majority of them lost weight though they improved in appearance during the two weeks on the new pasture. This pasture was rested from 1st to 22nd September when eighteen of the heifers were returned to it and grazed for a further fortnight.

Table IV gives the average, initial and final live weights of the cattle for each period on each plot.

TABLE IV.

Number of Animals and Initial and Final Average Live Weights for each Period on each Plot.

Period	Reseeded Plot		
	Number and Type of Animals	Initial Live Weight	Final Live Weight
		c qr. lb.	c. qr. lb.
15 July–29 July	17 Bullocks ; 2–2½ yr. old	7 0 8	7 1 11
16 August–1 September	21 Heifers ; 1–1½ yr. old	4 2 22	4 2 20
22 September–6 October ..	18 do. do.	5 0 23	5 1 10
	Old Pasture Plot		
28 May—16 June	17 Bullocks—2–2½ yr. old	6 0 11	6 2 5
29 July–12 August	17 do. do.	7 1 11	7 2 7
1 September–22 September ..	19 Heifers ; 1–1½ yr. old	4 3 3	5 0 19

The following are the number of cattle-grazing days and live weight increase per acre for each of the plots.

	Cattle-grazing Days		Live Weight Increase
	2–2½-year-olds	*1–1½-year-olds*	*cwt.*
Reseeded Plot	48	118	1.4
Old Pasture Plot ..	112	80	3.20

Although the young heifers actually lost weight during the first period on the reseeded plot and increased only by a few pounds per head during the second period, they had improved considerably in condition as judged by the eye during both periods.

Most of the grazing was obtained from the old plot early in the season and from the reseeded plot in the later part. Early summer drought adversely affected both plots. At the end of the grazing season both plots looked well and had a good sole of grass.

1942 SEASON.

There was a nice covering of grass on the reseeded plot at 20th April, on which date the cattle were put to graze on it. The old pasture was more than a fortnight behind it as the grass on it was just fair on 2nd May. In the early part of the season the herbage on the new pasture consisted mainly of ryegrass. Later, clovers and cocksfoot developed well.

The plots were grazed alternately up till 19th May with one lot of cattle consisting of heifers and bullocks twelve to sixteen months old. Subsequently bullocks only, of the same age, were used and the plots grazed alternately till the end of the season.

Grazing periods 1 and 2 on the reseeded plot were very dry while period 3 from 3rd to 16th July was very wet. Period 4 was reasonably dry while period 5 was wet. In wet spells the cattle on the reseeded plot scoured a good deal, and as a result, lost considerably in weight during periods 3 and 5. Nevertheless at the end of each of these periods they had improved in appearance. Scouring was not severe at any time on the old pasture plot.

Table V gives the initial and final average live weights of the cattle for each period on each plot.

TABLE V.

Average Initial and Final Live Weights, Type and Age of Animals at Beginning of Grazing Season.

Period	Number and Type of Animals	Initial Live Weight	Final Live Weight
	RESEEDED PLOT		
		c. qr. lb.	c. qr. lb.
(1) 20 April–2 May	20 bullocks and heifers; 12–16 months	3 3 15	4 1 12
(2) 19 May–1 June	22 bullocks; 12–16 mths.	4 0 15	4 1 9
(3) 26 June–16 July	Do. do.	4 3 22	4 3 4
(4) 18 August–4 September ..	21 Do. do.	5 1 21	5 2 4
(5) 25 September–2 October ..	20 Do. do.	5 2 16	5 2 3
	OLD PASTURE PLOT		
(1) 2 May–19 May	18 bullocks and heifers; 12–16 months	4 1 17	4 1 23
(2) 1 June–15 June	21 bullocks; 12–16 mths.	4 1 13	4 2 16
(3) 16 July–4 August	22 Do. do.	4 3 4	5 0 21
(4) 4 September–25 September ..	21 Do. do.	5 3 0	5 2 17

The following are the number of cattle-grazing days and the live weight increase per acre for each plot.

	Cattle-grazing Days	*Live Weight Increase*
Reseeded Plot	291	2.16 cwt.
Old Pasture Plot	291	3.15 cwt.

The live weight increase shown above for the reseeded plot is the total increase less the decrease for periods 3 and 5. The increase during periods 1, 2 and 4 amounted to 3.74 cwt. per acre.

During the season one bullock died and three developed red water.

1943 SEASON.

Both plots were closed up from the end of previous season's grazing trial. The reseeded plot was fit for grazing on 20th April, a fortnight before the old pasture plot. In the herbage on the reseeded plot there was a considerable

drop in the proportion of ryegrasses compared with the previous season, and clovers and cocksfoot did not develop as had been expected. Timothy formed a very small proportion of the herbage.

During the season the reseeded plot tended to become patchy and Yorkshire fog and bent grasses developed in patches where ryegrasses had become thin.

One lot of nineteen bullocks 12-16 months old at the beginning of the grazing season was grazed alternately on the plots, the length of the periods being decided by the growth of grass throughout the season.

Table VI shows the duration of each period, the initial and final average weights for each period on each plot.

TABLE VI.

Duration of Periods and Initial and Final Average Live Weights of Nineteen Bullocks.

Period	Reseeded Plot		Period	Old Pasture Plot	
	Initial Live Weight	Final Live Weight		Initial Live Weight	Final Live Weight
	c qr. lb.	c. qr. lb.		c. qr. lb.	c. qr. lb.
(1) 20 April— 3 May.. ..	3 2 0	3 1 23	(1) 3 May— 1 June ..	3 1 23	3 3 10
(2) 1 June— 26 June ..	3 3 10	4 0 14	(2) 26 June— 13 July ..	4 0 14	4 1 15
(3) 13 July— 4 August ..	4 1 15	4 2 1	(3) 4 August— 23 August ..	4 2 1	4 3 1
(4) 23 August— 2 September ..	4 3 1	4 3 9	(4) 2 September— 18 September	4 3 9	4 3 17
(5) 18 September— 28 September	4 3 17	5 0 3	(5) 28 September 9 October ..	5 0 3	5 0 12

The following are the number of cattle-grazing days and the net live weight increase per acre for each plot.

	Cattle-grazing Days	*Net Live Weight Increase*
Reseeded Plot	304	2.18 cwt.
Old Pasture Plot	350	3.94 cwt.

All the cattle remained healthy during the season.

During period 1 on the reseeded pasture the cattle scoured a good deal and as a result showed a drop in weight at the end of the period despite which they were much improved in appearance. As in the previous seasons there was throughout the season a considerable amount of scouring among the cattle grazing on the reseeded pasture which in all probability depressed the live weight gain. The difference in both the live weight increase and the number of grazing days is, however, significant. Apart from this, it was noticed that from the second period onward the cattle on the reseeded plot did a lot of selective grazing as a result of which the pasture became tufted and although grazed longer than was perhaps desirable the tufts were not eaten down. The old pasture was grazed much more evenly and the cattle appeared more contented while on it.

The reseeded pasture deteriorated gradually during the season and at the end had become coarse and open and contained a considerable proportion of bent and Yorkshire fog.

Over the three seasons the new pasture provided 713 grazing days of 1–1½-year-old cattle and 48 grazing days of 2–2½-year-old cattle per acre, the total live weight increase being 5.74 cwt. per acre. The corresponding figures for the old pasture plot are 721 grazing days of the older and 112 grazing days of the younger type of animals and 10.29 cwt. live weight increase. For the reasons already mentioned, these figures, although indicative, can scarcely be accepted as a fair representation of the relative values of the plots. What is perhaps of more importance is that on appearance at the end of the third season the reseeded plot was not as good a pasture as the other plot.

CLONAKILTY CENTRE.

1941 Season.

In 1941 a 10½-acre field, sloping slightly to the south, of light shallow soil on a subsoil of blue clay and gravel, which had been in pasture or meadow for forty years or more, was divided into two equal plots. The herbage on the field was poor and consisted to a considerable extent of bent, sweet vernal, Yorkshire fog and crested dogstail grasses and patches of rushes. One plot was ploughed to a depth of 6 inches in April, heavily rolled, disced and dressed with 25 cwt. lime and 2 cwt superphosphate per statute acre. The other plot was thoroughly harrowed and rolled and given a similar dressing of lime and superphosphate.

Four years previously the land had been given a moderate dressing of superphosphate and potash salts and was last under hay in 1938.

The following seeds mixture was sown on the tilled plot on 1st May at the rate of 44 lb. per acre:

	lb.
Perennial Rye Grass	14
Italian	4
Cocksfoot	8
Timothy	5
Rough-Stalked Meadow Grass	2
Late-flowering Red Clover	2
Alsike Clover	2
Wild White Clover	1

Drought, subsequent to seeding, delayed brairding. Early in June, however, there was a fairly uniform braird and by mid-July, ten weeks after sowing, the plot was fit to graze.

The old pasture plot was well forward and was stocked on 10th June and gave steady growth during the season. The cattle used were from $1\frac{1}{2}$ to $2\frac{1}{2}$ years of age.

The reseeded plot grew so rapidly from mid-July onward that much of the grass was being wasted from trampling and thirty-six lambs were added on 22nd July to the fifteen head of cattle already on the pasture. The grazing of the thirty-six lambs is calculated as equivalent to that of nine head of these cattle in reckoning the number of cattle-grazing days.

The reseeded plot provided 191 cattle-grazing days per acre.
The old pasture plot ,, 170 ,, ,, ,,

The cattle on the reseeded plot scoured so severely during dull, moist weather in July and August that they showed a loss in weight. Weighings were not made subsequently. Grazing was stopped early in November and the plots closed up for the winter.

During the season weeds, particularly redshank, tended to develop on the reseeded plot and the thistle cutter was used to clear them.

1942 Season.

The reseeded plot remained very green during the winter and growth was earlier on it in spring than on the old pasture plot. The herbage on the reseeded plot consisted mainly of Perennial and Italian ryegrass. On 20th April twelve yearling bullocks were put to graze on the reseeded plot and eight on the old pasture plot. Subsequently, as the surface of the reseeded plot became more firm heavier cattle were used, each plot being grazed with eight 2-year-old bullocks.

A period of severe drought occurred in June from which time onward the grass on the reseeded plot made poor growth and the cattle on this plot from mid-August onward lost considerably in weight. From 25th May to 17th August they had increased in live weight by 1.8 cwt. per head on the average. The colour of the plot changed, the grass became wiry and little clover showed except where the grass had been eaten bare.

Table VII gives the initial and final average live weight for each lot of bullocks on each plot.

TABLE VII.

Duration of Periods, Type of Cattle and Initial and Final Average Live Weights.

Type of Cattle	Period	Reseeded Plot		Old Pasture Plot	
		Initial Live Weight	Final Live Weight	Initial Live Weight	Final Live Weight
		c. qr. lb.	c. qr. lb.	c. qr. lb.	c. qr. lb.
Yearling bullocks ..	20 April–25 May ..	4 1 21	4 3 27	4 1 3	4 2 27
2-year-old bullocks	25 May–3 October	6 2 18	7 2 6	6 3 7	8 1 8

The following are the net live weight increases and the number of cattle-grazing days per acre for the two plots.

	Cattle-grazing Days	*Net Live Weight Increase*
Reseeded Plot	320	2.92 cwt.
Old Pasture Plot	292	3.45 cwt.

1943 SEASON.

The plots were without stock during the winter and early spring. Growth was again much earlier on the reseeded plot and eight bullocks, 2–2½-years old, were put on to graze it on 2nd April. On the same date six similar bullocks were put on the old pasture plot. The bullocks were weighed and the lots interchanged on the plots, every six weeks approximately, extra animals being added or removed according to state of the pasturage.

The reseeded plot had a rich green colour throughout the season, the principal grasses in it being ryegrasses, cocksfoot and timothy. A fair amount of wild white clover was also in evidence and little bent grass or weeds developed. The herbage inclined to become patchy as the season advanced.

The old pasture plot, despite severe harrowing, contained much bent grass. It produced a close mat of herbage and when grazed bare the herbage lacked colour. Despite this, however, cattle put to graze the plots in common after the last grazing period in the trial was concluded showed a marked preference for the old pasture plot. This rather confirmed the observation made during the summer that when cattle were changed from the old pasture to the reseeded plot they were somewhat discontented for a few days, while those changed in the opposite direction settled down almost immediately.

Table VIII gives the duration of each pèriod, the number of bullocks and the average initial and final live weights for each plot and period.

Table VIII.

Average Initial and Final Live Weights for Each Lot of Bullocks on Each Plot for Each Period.

Period	Reseeded Plot			Old Pasture Plot		
	No. of Bullocks	Initial Live Weight	Final Live Weight	No. of Bullocks	Initial Live Weight	Final Live Weight
		c. qr. lb.	c. qr. lb.		c. qr. lb.	c. qr. lb.
2 April–14 May ..	8	7 0 27	7 3 17	6	7 1 0	8 0 1
14 May–25 June ..	6	8 0 1	8 2 14	8	7 3 17	8 2 25
25 June–6 Aug. ..	5	8 2 25	9 0 21	5	8 3 3	9 1 18
6 Aug.–17 Sept. ..	5	9 1 18	9 2 6	7	9 1 6	9 2 22
17 Sept.–29 Oct.	6	9 3 1	10 0 22	5	9 2 6	10 1 22

The following are the number of cattle-grazing days and the live weight increase per acre for each plot.

	Cattle-grazing Days	*Live Weight Increase*
Reseeded Plot	230	2.91 cwt.
Old Pasture Plot	230	4.21 cwt.

During the three seasons at Clonakilty the reseeded plot provided a total of 741 grazing days per acre as compared with 692 for the old pasture plot. For the two final seasons of the trial the total live weight increase per acre was 5.83 cwt. for the reseeded plot and 7.66 per cwt. for the old pasture plot. Judged on appearance and on the preference shown by the stock the old pasture was the better at the end of the three seasons grazing.

BOTANICAL ANALYSIS.

The botanical composition of the pastures as indicated by analyses made in June and July, 1944, and shown in Table IX indicate that at Athenry the reseeded plot would appear to have reverted almost entirely to the old herbage, only a small proportion of cocksfoot and timothy having survived. At Ballyhaise and Clonakilty, on the other hand, perennial ryegrass continued to form a very large proportion of the herbage on the new pasture while a small proportion of cocksfoot was found in this pasture at both centres. Apart from this predominance in the proportion of perennial ryegrass, the most outstanding feature shown by the analysis is the establishment of wild white clover and the small proportion of bent grass in the reseeded plot at the Clonakilty centre.

TABLE IX.

Botanical Composition of the Pastures at Each Centre, June-July, 1944.

No.	Species	Athenry		Ballyhaise		Clonakilty	
		Old Pasture %	New Pasture %	Old Pasture %	New Pasture %	Old Pasture %	New Pasture %
1	Perennial Rye Grass ..	9.0	5.8	18	46	2.2	40.9
2	Italian Rye Grass ..		.8		4		2.9
3	Cocksfoot		4.8		2		2.7
4	Timothy		2.1		.5		.3
5	R. S. Meadow Grass ..		.4	4	1	36.5	26.8
6	Crested Dogstail ..	4.0	4.1	6	1	8	
7	Meadow Foxtail ..			12	12		
8	Meadow Fescue ..				.5		
9	Yorkshire Fog ..	12.9	15.1	2	6	13.9	.3
10	Bent Grass	7.8	11.1	8		27.2	1.7
11	Sweet Vernal	5.5	2.4	4	3		4.4
12	Sheep's Fescue ..	27.6	31.1				
13	Red Fescue					8.9	1.0
14	S.S. Meadow Grass ..					1.3	
15	Soft Brome						.8
16	Red Clover	1.5	1.2	2	1	} 0.8	16.7
17	Wild White Clover ..	8.3	7.8	20	15		
18	Crowfoot	3.0	2.2	6	2		1
19	Chickweed	.3	.6				
20	Self Heal	3.5	3.3				
21	Yarrow	1.3	.9				
22	Hawkweed	.8	.1				
23	Sheep's Sorrel	1.4	.1	10	2		
24	Plantain	10.2	1.6	1		.4	
25	Dandelion	.4	.2				
26	Daisy	1.9	4.2	6	3		
27	Quaking Grass ..	.4					
28	Thistle		.1				.2
29	Dock						.2
30	Other Weeds		.3	1	1	.4	

Rainfall, in inches, at each centre during the period of the trials was as follows :—

ATHENRY.

Month	1940	1941	1942	1943
	ins.	ins.	ins.	ins.
January	2.85	2.05	4.45	5.76
February	3.53	3.62	1.40	2.39
March	4.69	3.25	1.97	0.96
April	3.09	1.50	2.29	1.22
May	1.20	1.79	4.66	3.47
June	1.17	1.13	.25	3.93
July	2.87	2.86	4.54	2.81
August	.57	3.76	4.24	6.43
September	2.54	1.78	5.10	2.95
October	5.50	4.02	3.74	5.01
November	3.07	5.05	1.05	3.11
December	4.63	2.51	4.28	2.81
TOTALS	35.81	33.32	37.97	40.85

BALLYHAISE.

Month	1941	1942	1943
	ins.	ins.	ins.
January	2.46	4.32	5.54
February	2.77	1.61	1.95
March	3.05	3.09	2.11
April	1.61	—	1.55
May	2.01	4.62	3.16
June	1.04	0.12	3.65
July	2.10	3.51	2.88
August	3.57	4.95	6.30
September	1.65	4.83	2.72
October	4.86	2.67	3.59
November	4.47	0.77	3.07
December	1.95	5.58	2.48
TOTALS	30.94	36.07	38.[illegible]

CLONAKILTY.

Month	1941	1942	1943
	ins.	ins.	ins.
January	4.29	4.72	7.97
February	4.22	0.87	1.75
March	3.79	3.56	1.05
April	1.50	1.95	2.01
May	2.20	4.72	4.77
June	1.44	0.51	3.03
July	3.00	2.60	2.73
August	3.67	4.36	3.51
September	0.95	2.92	3.33
October	3.15	1.26	5.68
November	7.79	0.50	2.47
December	2.29	4.73	2.19
TOTALS	38.29	32.79	40.49

SUMMARY.

Plots of moderate to poor pasture at three centres were reseeded with grass seeds and clovers in the spring of 1940 at one centre and the following spring at the other two.

The plots were given a suitable dressing of phosphatic manure (and lime in the case of the Clonakilty plots).

The following are the dates of sowing the seeds and of stocking the new pasture for the first time at each centre :—

	(*a*) Seeds sown	(*b*) Plots first stocked	Number of days from (*a*) to (*b*)
Athenry	15th April	26th July	102
Ballyhaise	14th May	15th July	62
Clonakilty	1st May	15th July	75

At Athenry the seeds came up quickly but growth was slow during June owing to drought. At Ballyhaise sowing was delayed due to spring drought. There was a partial braird after sowing, but a proportion of the seed did not braird till rain fell early in July. At Clonakilty drought followed sowing and delayed brairding by three weeks.

Two years after it was laid down the reseeded plot at Athenry suffered rather severely from summer drought, the effect being, no doubt, aggravated by hard grazing during the previous spring. Except for the period immediately after sowing and which also adversely affected the old pasture plot, no periods of undue drought were experienced at Ballyhaise. At Clonakilty severe drought occurred in June, 1942, and its effect on the reseeded plot was most pronounced.

In general, the old pasture plots suffered less ill effects from drought than did the reseeded plots.

At Athenry and Clonakilty all the grasses and clovers established themselves satisfactorily in the first season. At Ballyhaise the development of clover was not so good, but the establishment of the grasses was satisfactory.

Two years after reseeding, weed development became evident in the reseeded plot at Athenry and in the third year it was necessary to use the thistle cutter. Of the smaller weeds plantain, daisies, and crowsfoot were most in evidence. At Ballyhaise and Clonakilty the reseeded plots remained free from weeds except for some redshank and knotgrass which appeared at Clonakilty during the summer following reseeding.

At all three centres growth in the spring of the years following reseeding was at least two weeks earlier on the reseeded than on the old pasture plots.

The grazing capacity of the new pastures was compared over three successive seasons with that of similar plots of old herbage which had received similar

treatment in respect of manuring. The plots were grazed with young stock varying from one to three years old at the beginning of each grazing season. Lambs were used for a short period at one centre. The results were measured in terms of live weight increase and cattle-grazing days.

At one centre the reseeded plot gave a much higher live weight increase than did the old pasture plot during the first trial season. The position was reversed in each of the two succeeding seasons. At the other two centres the live weight increase was greater from the old pasture plot in each season.

At one centre the reseeded plot provided 192 days grazing per acre more than the old pasture plot over the three seasons. At another centre there was a small difference in favour of the reseeded plot while at the third centre there was a slight difference in favour of the old pasture plot.

At all three centres at the end of the trials the reseeded plot appeared the poorer quality pasture and a marked preference was shown by the cattle towards the end of the trials and thereafter for the old pasture plots. Not only was the sward on the old pasture plots at all centres much more dense than that on the reseeded plots at this stage but as indicated by the botanical analysis the proportion of clovers in the sward was greater in the case of the old pasture plots at two centres.

In considering the foregoing results it must be recognised that the system of measurement cannot be regarded as entirely satisfactory. The variations which occur in live weight in animals under such circumstances are well known. In addition, the extent to which the laxative effect of the new grass affected the weights is difficult to assess. To the eye, the animals on the reseeded plots at the end of some periods had improved in condition and appearance, but showed a loss or only slight gain in live weight. These animals in many cases subsequently went on to the old pasture plot which, being apparently less laxative, produced what was probably a rather fictitious increase in live weight and are thus credited with gains, part of which really may have been produced by the reseeded pasture. In regard to the number of days grazing the object was to graze each plot to the best advantage at all times but at the same time in such a manner that the relative returns could be measured. It is possible or even probable that better returns would have been obtained from the reseeded plots had it been possible to graze them for short preriods at the start, allowing the stock to run on to rough pasture in the intervals. Such procedure might have obviated a good deal of the scouring which occurred at Ballyhaise and Clonakilty where it was unavoidably found necessary to graze the plots to a great extent with young stock.

These considerations prevent conclusive deductions being drawn pending the result of further trials which are being carried out. Apart from the superiority shown in the first trial year by the reseeded plot at Athenry, the only advantage applying generally at all three centres from direct reseeding was the earlier grazing provided.

INFECTIOUS DISEASES OF POULTRY

By Professor W. Kearney, M.R.C.V.S. and Mr. C. B. Adams, M.R.C.V.S.,
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In view of the expansion now taking place in the poultry industry and the importance which this branch of agriculture is likely to assume in the future, it is deemed advisable to include an article in this *Journal* on certain diseases to which poultry in this country are subject so that persons engaged in poultry breeding and rearing, and particularly those with little experience, may become aware of the significance of these diseases and be informed regarding ways and means of avoiding losses from them.

There exists in this country, as in most other countries, a number of infectious complaints of poultry, some of which may cause serious losses among flocks unless suitable precautions are taken to prevent their occurrence. The most serious of these complaints are set out in the following table which shows the degree of their incidence, actual and relative, as observed in specimens of dead poultry sent to the Veterinary College from various parts of the country during the past nine years :—

The Table does not give details of non-infectious disorders, which on the aggregate are more prevalent but potentially are of less harm to the industry. These arise mostly from errors in feeding and management and can be overcome by exercise of reasonable care in these respects.

It must not be deduced from the list of infectious diseases that poultry-keeping is a hazardous undertaking in this country. On the contrary the health of Irish poultry is of a high standard compared with that of poultry in many other countries. This favourable state is due mainly to two influences, namely, the negligible inward trade in poultry and eggs from other countries where more virulent forms of disease occur and which probably would arise here otherwise, and the system of free-range husbandry which is invariably adopted here. Infectious forms of disease in poultry are only likely to assume serious proportions under intensive systems of husbandry which involve overcrowding and insanitary conditions of living. The bulk of poultry-rearing in this country has been carried out by the average farmer's wife under free-range conditions which do not favour the occurrence of major outbreaks of disease and so long as this practice continues undue interference

DISEASES	1935/36		1936/37		1937/38		1938/39		1939/40		1940/41		1941/42		1942/43		1943/44	
	Number of Cases	Percentage of Total Specimens	Number of Cases	Percentage of Total Specimens	Number of Cases	Percentage of Total Specimens	Number of Cases	Percentage of Total Specimens	Number of Cases	Percentage of Total Specimens	Number of Cases	Percentage of Total Specimens	Number of Cases	Precentage of Total Specimens	Number of Cases	Percentage of Total Specimens	Number of Cases	Percentage of Total Specimens
Coccidiosis	226	11.6	272	12.3	353	13.5	337	12.3	308	11.6	413	12.9	337	12.0	332	11.9	318	9.9
Bacillary White Diarrhœa ...	179	9.2	211	9.5	225	8.6	231	8.5	181	6.8	167	5.2	192	6.9	183	6.5	171	5.3
Tuberculosis	124	6.4	151	6.9	158	6.1	186	6.8	146	5.5	234	7.3	204	7.2	185	6.6	186	5.8
Worm Infestation	110	5.7	87	3.9	265	10.2	138	5.2	110	4.5	190	5.9	201	7.2	184	6.5	226	7.0
Blackhead	126	6.5	127	5.7	64	2.5	90	3.3	99	3.7	75	2.3	127	4.5	203	7.2	196	6.1
Leukosis	57	3.0	44	2.0	95	3.6	119	4.3	172	6.5	226	7.1	113	4.0	172	6.1	190	5.7
Fowl Typhoid	33	1.7	27	1.2	32	1.2	15	0.5	18	0.7	27	0.9	21	0.7	20	0.7	33	1.0
Other Complaints	1,084	55.9	1,293	58.5	1,412	54.3	1,615	59.1	1,615	60.7	1,867	58.4	1,612	57.5	1,530	54.5	1,899	59.2
TOTAL YEARLY SPECIMENS ...	1,939		2,212		2,604		2,731		2,658		3,199		2,803		2,809		3,209	

with the industry by disease will be precluded. There has been a tendency of late, however, to intensify the rearing of poultry here with a high incidence of disease in some cases as a consequence. Such a tendency is not deprecated so long as suitable hygiene and management, as well as other precautionary measures against disease, are maintained.

It is not possible in the space available to give more than a brief account of the diseases of major importance. Further information on the subject can be obtained from Poultry Instructors or direct from the Authors.

COCCIDIOSIS.

As will be seen from the Table this is the most prevalent of all the infectious complaints of poultry and it is well known by many breeders to be responsible for a high mortality amongst their chickens from year to year and for wasting in older birds. Turkeys and other domestic poultry are only rarely affected by this complaint.

The disease is caused by a microbe called a coccidium of which there are several types or species. some being more virulent than others. Hence we find much variation in the severity of the illness they create. Young chickens from a few weeks to a few months old suffer most severely and the mortality rate is usually high amongst them following the occurrence of an outbreak in a flock. Adult birds may sometimes become acutely affected also and some may die but more commonly they suffer from a chronic form of infection or become "carriers" of the microbe without necessarily showing ill effects.

In its acute form amongst chicks, blood-stained droppings are frequently passed and the chicks rapidly become weak and anæmic and many die within a few days after the occurrence of the outbreak. Some of the chicks may be found dead without previous illness being observed. In the chronic form, as it affects older stock, unthriftiness and gradual weakness take place until in some cases the birds are unable to walk. Diarrhœa is usually present in these cases but blood is not observed in the droppings as a rule. A proportion of these chronic cases die but the majority recover gradually. Some of those that appear to recover from the disease may retain the microbe in their intestines, however, and become "carriers" and distributors of the infection through the medium of their droppings.

Post mortem examination of chicks which die from the acute form reveals blood in the cæcal tubes or blind gut with paleness of the flesh from anæmia. In chronic cases the body is poorly nourished, the flesh is pale and moist and the first portion of the intestine is usually reddened and thickened. In some

cases, however, little abnormality is seen. The disease can only be diagnosed with certainty by examining the droppings or bowel contents with a microscope and observing the microbes in that way. Hence it is advisable, when the disease is suspected, that a few dead birds should be sent without delay for expert examination in this way.

When the disease breaks out amongst a small group of chickens of no great value experience has shown that it is more advantageous in the long run to kill off the entire batch at once and to bury or burn them, together with their droppings and all litter in the house or hover, which may have been contaminated by them, and to disinfect the hover or house and the feeding utensils by scrubbing them with a strong solution of ammonia (10 per cent.) or fumigating with ammonia vapour. Moreover, any outside ground to which the chickens had access should be disinfected as far as possible, either by covering with quick lime or by burning straw or litter on it, to kill the microbes there. Caution is necessary to prevent fences and houses catching fire. If such ground cannot be thoroughly disinfected in these ways it should not be used again for at least twelve months, since the microbes are capable of living in the ground for that length of time. When the batch of stricken chickens is valuable, the following treatment is advised :—to each pint of hot drinking water add one tablet or 7½ grains of the drug called sulphamezathine, and allow the chicks free access to this for seven days and during that time clean out the house and burn the droppings and litter daily. This drug, while being satisfactory for coccidiosis in chickens, has not been yet proved to be so effective for chronic coccidiosis in older poultry but it should be given a trial also with these when the disease is causing serious interference with their health. Despite this drug-treatment some of the recovered birds may continue to harbour the microbe for some time afterwards and consequently continue to distribute infection in the houses and ground to which they have access. Therefore disinfection of such places should be continued for some time after the disease has subsided, and fresh drafts of young chickens should be kept away from the environs of the infected flock, otherwise they will probably contract the disease from them. In view of the trouble and annoyance which these curative measures entail it must be obvious to breeders that it is far better to adopt precautionary measures against contracting the disease in the first instance ; consequently we strongly advise that when purchasing breeding stock from other farms or establishments, care should be taken that such sources are and have been free from this disease, because many healthy-looking birds obtained from infected establishments are known to be "carriers" of the microbe. When breeders are in doubt as to the health of poultry from which they wish to obtain fresh breeding stock they should consult the Poultry Instructor as she is likely to know best about this. There is little danger of coccidiosis being contracted through the medium of eggs but even these should only be procured from healthy stock.

BACILLARY WHITE DIARRHŒA.

This highly fatal disease of young chicks appears to be on the decline in this country at the present time. Following its introduction in a consignment of day-old chicks from overseas in 1924 it spread widely through the country for a number of years and but for the application of blood-testing and the culling of infected adult breeding stock which act as "carriers" of the microbe and transmit it through their eggs to their chicks, it is likely that the disease would have reached serious proportions by now and caused much harm to the industry.

The disease is caused by a microbe known as the B. pullorum which is highly virulent for chicks but only moderately so for older birds. Turkey and pheasant chicks become affected occasionally but the ordinary fowl chick is the common victim. Adult breeding stock, which happen to recover from the infection in chickhood, as well as some which pick up the disease in later life, become "carriers" without showing any illness. These "carriers" are the main source of the infection for chicks, since a proportion (about 15 per cent.) of their eggs contain the microbe, which multiplies in the bodies of young chicks that hatch within the eggs killing a proportion of them before they are born and a further proportion within a few days after being hatched. These latter infect their mates in the incubator or nest by means of their droppings and thus the great majority of the brood die within a few weeks of birth. Those that survive retain the microbe in their bodies, and particularly in their genital organs, indefinitely, and become a subsequent and continuous source of the disease through the medium of their eggs and to a lesser extent through the medium of their droppings. In this way the disease becomes propagated from generation to generation and expands through the country by means of infected eggs and breeding birds.

To diagnose this disease with certainty a few of the dead chicks should be sent to the laboratory, since post mortem evidence is not always apparent to the naked eye. In the majority of chicks, however, the intestines are inflamed and contain casts of grey material; grey spots are observed in the lungs and elsewhere in some cases, and the liver is swollen and mottled in appearance in most specimens. To detect "carrier" adults, which may be male birds as well as females, the easiest way is to have them blood-tested. The poultry instructors will carry out this test when requested by breeders.

To prevent the occurrence of the disease among their flocks, breeders are strongly advised to procure hatching eggs, as well as day-old chicks and breeding birds, only from B.W.D.—free sources. Poultry instructors should be consulted in this respect before purchases are made.

As no drug, or other means, has yet been devised to cure affected chicks or to rid "carriers" of the infection the best thing to do when the disease

makes its appearance amongst a small brood of chicks is to kill them all off and to bury or burn them and afterwards to thoroughly cleanse and disinfect the incubator, hover or other place contaminated by them. The most suitable disinfectant for the incubator is fumigation, by placing two teaspoonfuls of potassium permanganate mixed with two tablespoonfuls of formalin (40 per cent.) (obtainable from chemists) within the closed hot incubator until all liquid is evaporated. The capsule and thermometer should be removed previously and any matting in the incubator taken away and boiled in water. The incubator should be fully aired afterwards. Contaminated hovers and houses can be disinfected, after burning the litter and droppings, by applying ordinary proprietary disinfectants to the floors and feeding utensils. This microbe is more easily killed by these disinfectants than is that of coccidiosis. When the affected brood is large and valuable it may be considered worth while leaving the disease run its course amongst the chicks so that those which survive the outbreak may be salvaged. In this event the healthy-looking chicks should be isolated at once from the sick ones and placed in a clean house, thus endeavouring to prevent the infection reaching them. The sick ones should be killed off, however, as they are unlikely to recover, and the incubator or house disinfected as recommended above. Chicks that survive the outbreak should not be used later for breeding purposes, as some, if not all, are likely to become "carriers." They may be used for table purposes or be kept for production of eating eggs, but in this event they should be kept away from other poultry on the farm.

Precautions against contracting the disease are well worth while. They entail an assurance when eggs and day-old chicks are being purchased, that they come from B.W.D.—free stock and that adult breeding birds have likewise been obtained from healthy flocks. When the purchaser is in doubt as to the health of the stock from which purchases are to be made he should consult the local poultry instructor as she is likely to be the best judge in this matter. Before breeding from one's own stock, following an outbreak of the disease, it is recommended that the stock should be blood-tested, in order to detect any that may be "carriers" of the infection. Arrangements for blood-testing should always be made through the local poultry instructors. One blood-test should not be relied upon. If reactors occur in the first test, at least a second test should be carried out, but to make doubly sure that no reactors are left in the flock, a further test is advised.

TUBERCULOSIS.

Although this disease, as encountered by us, shows increasing frequency in recent years it is probable that its incidence in the country is no higher than in previous years. The more likely explanation for the apparent increase is that breeders are becoming more disease-conscious and are sending in more specimens than before. Nevertheless, it is known that in some flocks it is

responsible for a high mortality rate at the present time, and as avian tuberculosis is frequently transmitted to pigs and occasionally to cattle also, all possible efforts should be made to eradicate it from flocks already infected and to prevent it being contracted by healthy birds and other animals.

All species of poultry suffer from this disease : in fact all avians, whether wild or domesticated, suffer from the disease or are liable to suffer from it when they are kept in captivity, but fowl, and especially old fowl, are the common victims. Turkeys, ducks and geese are not frequently affected.

The microbe of avian tuberculosis is similar in many respects to that which causes tuberculosis in the larger animals and in human beings but fortunately it does not infect human beings or animals other than pigs and cattle. The infection is usually introduced into healthy flocks by means of infected fowl obtained from flocks in which the disease happens to be present. Such fowl do not necessarily show signs of the disease at the time of purchase and it is impossible to determine whether such birds are infected or not except by means of the tuberculin test. The infection may, on rare occasions, be brought into healthy flocks by indirect means such as on the boots of people and by wild birds and animals from nearby infected flocks.

Symptoms of tuberculosis in fowl do not develop until the disease is well advanced as a rule and even then they are not sufficiently definite to make a positive diagnosis during life except by applying the tuberculin test to them. In the majority of cases, however, affected birds waste away and become weak. Some develop lameness and others diarrhœa, but since similar symptoms occur from other complaints these are not diagnostic by themselves. Therefore, when suspected cases arise in a flock, one should be killed off and sent for post mortem examination. At this examination it is usual to see grey or yellow spots in the liver and spleen and ulcers in the intestines. Some fowl die suddenly from rupture of their diseased livers, in which case the abdomen will contain large blood clots. The tuberculin test should be applied by an experienced person such as a veterinary surgeon or poultry instructor.

Owing to its infectious nature, and the losses it creates, every effort should be made to avoid the disease by ensuring that birds procured from outside sources come from healthy flocks or are subjected to the tuberculin test before they are placed in the flock. When the disease breaks out all ailing birds should be killed off and the tuberculin test applied to the remainder. Reactors to the test should be killed off also and burned or buried unless the number is large. If the number of reactors is large and provided they show no gross lesions and are in good condition, the flesh may be used for human consumption after removing the entrails, including the liver. Following the disposal of the reactors the remainder of the flock should be moved to fresh ground and housed temporarily elsewhere than in the old house. The latter, including

the feeding utensils, should then be thoroughly cleansed and disinfected and all litter and droppings burned, and the house left vacant for at least a month before returning the flock to it. The flame of a blow-lamp is the most reliable disinfectant, but scalding water containing washing soda applied liberally is also effective. The runs that were occupied by the infected flock should be covered with quicklime and left vacant for six months or straw or other material burned on them to destroy infection before returning the healthy flock to them. The tuberculin test should be applied to the flock again before returning them to the old quarters to ensure that they are all still healthy and should any reactors again occur the latter should be killed off. In our experience the disease has been eliminated completely from infected flocks in this manner, but in some cases the tuberculin test and disinfection had to be applied on more occasions than two before complete clearance was effected.

WORM INFESTATIONS.

There is little doubt that worms of various kinds are responsible for much illness and mortality in poultry flocks that are crowded into and maintained in confined spaces from one year to another. The increased frequency of this complaint, as revealed by our statistics, is no doubt due principally to the overcrowding and unhygienic conditions that obtain in some establishments from which specimens have been sent to us.

There are several species or types of worms that infest poultry and cause sickness amongst them. These parasites are spread from bird to bird and from flock to flock either directly by the droppings of infested birds or indirectly by insects and other intermediate hosts that happen to be in the ground occupied by the flock. The principal types of worms found in this country are : *gapeworms* which cause gaping and suffocation, principally in chickens : *tapeworms* which infest older fowl ; *threadworms* which are so small that they cannot easily be seen with the naked eye ; *roundworms* which can readily be seen in the intestines and a thread-like worm which occurs in the gizzards of young geese and in some farms causes a high mortality amongst the goslings every year. In addition to these harmful types there is the common cæcal worm which is seen in the blind gut of most poultry and which, though harmless in itself, is an intermediate host for the microbe of blackhead (*see* page 73).

Space does not allow a description of the symptoms in each type of infestation but, excepting gapeworms and cæcal worms, they can, collectively, be said to cause loss of flesh and weakness with or without diarrhœa and may ultimately cause death in a proportion of cases. Birds that appear to recover from the primary infestation with these parasites frequently continue to harbour them or become "carriers" and so become a continuous source of the infestation for young and clean stock that may be added to the flock

from time to time. As more and more healthy stock are added so does the accumulation of worm eggs increase in the runs and houses until ultimately every bird in the flock is likely to become heavily infested. Earthworms, slugs and insects in the runs pick up the worm eggs dropped by the infected poultry and when they are consumed they transmit the infection to the healthy birds in turn.

When this condition is suspected in a flock one or two cases should be sent to the laboratory, after being killed, in order to determine the type of worm concerned. When this is established appropriate drug treatment can then be administered on directions prescribed by the laboratory or by the poultry instructor. Different drugs are used for the different worms. For example, carbon tetrachloride is used for roundworms and thread-worms. Kamala or areca nut for tapeworms, phenothyazine for cæcal and round worms and barium antimony tartrate powder for gapeworms. Some of these treatments are not very efficacious and so long as the treated birds remain exposed to re-infestation in infested runs and houses they are liable to become ill again despite the treatment. Consequently the flock should be changed to fresh ground and houses following the treatment while the old runs and houses are disinfected. Disinfection should be carried out on the lines recommended above for coccidiosis since the eggs of these parasites are highly resistant to ordinary disinfectants.

As in the case of other infectious diseases it will be found far better and more economical to adopt precautionary measures against worm infestations than to apply curative treatment. Consequently we advise here also that healthy flocks should be safe-guarded by taking the simple precaution not to purchase breeding stock from other places unless these are known to be healthy.

BLACKHEAD.

This infectious disease affects young turkeys principally, but occasionally is encountered in grown turkeys and in fowl also. The disease has shown a marked increase in turkey specimens that have been sent to us during the past few years. This increase is probably the result of an increased interchange in breeding stock consequent on the demand for turkeys in recent years.

The microbe of this complaint attacks the intestines and the liver, causing severe and usually fatal changes in them. The name "blackhead," which is a misnomer, was coined for the complaint because of the purple colour of the head which takes place in some cases. The infection is passed from bird to bird by means of the common cæcal worm, which most turkeys and fowl harbour, when they happen to be infected with the microbe of blackhead at the same time. The post mortem changes are usually sufficiently characteristic to make

diagnosis and they take the form of ulcers in the intestine and grey firm areas in a swollen liver, but in some cases there may be little change observed. Some adult fowl and turkeys appear to harbour the microbe without suffering therefrom and these "carriers" are also a means of spreading the disease from one flock to another.

The treatment for blackhead consists of dosing the infected chickens with one of the arsenical preparations, obtainable from poultry instructors or chemists, which are specific for the purpose. These preparations may be given in the food or by pill or by injection. The results are usually satisfactory if the treatment is administered in time. But prevention is probably the better way of dealing with the disease. This entails dosing the adult breeding turkeys on infected farms a few weeks before the hatching season begins, with phenothyazine, at the rate of 15 grains per bird on two successive days, so as to cause them to evacuate the cæcal worms they may be harbouring and which may be responsible for subsequent infection of the chickens otherwise. Following their treatment the adult birds should be removed to fresh ground together with the chicks as the latter are hatched out.

FOWL LEUCOSIS.

We are including under this title a number of complaints which are so closely allied that they can be considered as one condition for practical purposes. They consist of (1) paralysis of one or both limbs, and/or drooping of the wings, due to disease of the nervous system; (2) blindness of one or both eyes due to contraction and greyness of the pupils; (3) tumours in the internal organs called sarcomas and (4) a blood disease called leukæmia.

All these manifestations of disease appear to be due to infection by what are called viruses which are passed from bird to bird either directly or indirectly. Certain fowl appear to be specially prone to them and consequently when any of these conditions arise in a flock it is inadvisable to breed further from the flock. It appears from our statistics that these infections spread from flock to flock chiefly through the medium of breeding birds and in some cases through eggs as well. In other countries some of these conditions have assumed serious proportions and stringent precautionary measures have been taken there to restrict them by eliminating infected stock and preventing distribution of eggs and breeding birds from infected establishments. A similar policy is indicated here. There is yet no specific cure for these diseases and consequently we recommend that care be taken when purchasing eggs and breeding stock from outside sources that none of these diseases is present in them.

When the disease is diagnosed at the laboratory, which is the only place it can be diagnosed definitely, diseased birds should be culled at once and the

healthy stock removed from the ground and houses until these have been disinfected. The eggs from the flock should not be used for breeding purposes but may be used for table without danger to consumers.

FOWL TYPHOID.

As the name of this disease suggests, the microbe that causes it is related to that which causes human typhoid fever but differs in the important aspect that it is not infective for humans nor, indeed, for other animals. It is a disease of fowl only. The symptoms are not characteristic. Most birds die after a few days drowsiness and diarrhœa. The post mortem signs are a large greenish liver and an inflammation of the intestines, but diagnosis should be confirmed always by laboratory examination.

Treatment may take one of two forms according to circumstances, namely, vaccination or blood-testing. The vaccine can be procured through the poultry instructor. It protects against the infection but does not cure birds already sick or in the incubation period of the disease. Blood-testing is carried out to identify any "carriers" that may be in the flocks. Such carriers are then removed and the houses and runs subsequently disinfected. Farm-yard pools and dirty houses and runs quickly become polluted by "carriers."

In addition to the diseases dealt with, other complaints are known to occur, for example, deficiency diseases, laying and digestive disorders, the latter occurring particularly among chicks raised intensively on unsuitable and indigestible food. In this latter connection we would point out that the mortality rate among young chicks from unsuitable diet has been high in recent years. Whilst it has not been possible to determine the exact factors responsible in some cases it would appear that old and musty grain and coarse food with a high fibre content have been chiefly responsible.

By way of summary we would emphasise the following points:— (1) Prevention of disease is well worth the trouble involved since curative treatment is not always successful and is usually costly, and furthermore it is only by the exercise of preventive measures generally that we can hope eventually to control and eradicate from the country the infectious forms of it. In this regard it is particularly recommended that save in exceptional circumstances only hatching eggs or day-old chicks should be procured from outside sources and secondly that young stock should be raised strictly isolated from adults. (2) Breeders should consult poultry instructors more frequently than they do in regard to disease control and prevention. (3) For the maintenance of healthy poultry the most hygienic conditions of housing and the exercise of careful management are essential.

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MASTITIS OR MAMMITIS IN CATTLE

This disease, also known as "Garget," "Blast," "Start," "Weed," "Udder Clap," etc., is an inflammation of the udder. There are two main forms of it, the chronic and the acute. Briefly, in the chronic type there is a hardening or induration of the udder which is usually painless, a gradual shrinkage in the size of the udder or of the affected quarter, a lessening of the volume of milk produced, and finally atrophy or wasting of the udder or affected quarter and a cessation of the milk supply. At the onset of the disease in the chronic form the milk may not be altered in character but as time goes on it may show flakes or pus, become watery or even greenish-yellow in colour.

In the acute forms of mastitis the udder is usually hot and painful, the animal gravely ill and the secretion changed in appearance being often watery, blood-stained or containing pus.

All cases of mastitis are due to micro-organisms acting either singly or conjointly as in mixed infections. There are, however, predisposing causes, such as exposure to cold and wet after calving, wounds of the udder and teats, irregular and careless milking, the milking of healthy cows immediately after the milking of cows affected with mastitis, the use of milking machines with too high a vacuum, or leaving the cups of the milking machine on too long, or failure to clean and sterilise milking machines.

Mastitis usually occurs in cows although cases in maiden heifers are not uncommon. Many authorities believe that Mastitis in dairy cattle causes a greater economic loss than any other disease to dairy farmers of this or other countries at the present time.

Mastitis may be caused by a variety of micro-organisms and there are many types of the disease. A short description of the four main types follows :—

1. Tuberculosis Mastitis.

2. Summer Mastitis or Corynebacterial Mastitis due to an organism called Corynebacterium Pyogenes.

3. The common acute Mastitis occurring after calving or sporadically, usually caused by an organism of the genus Staphylococcus, hence called Staphylococcal Mastitis.

4. The common chronic type of Mastitis due to an organism called Streptococcus Agalactiae or Streptococcal Mastitis.

Before dealing briefly with each of the above types it is necessary to stress

that any departure from the normal in a cow's udder, any change in the milk, any heat or pain, swelling or hardening, ought to be looked on with seriousness, as, if neglected, any such condition may lead to the loss of the quarter or udder, or to the death of the cow, or in tuberculosis mastitis to infection of the farmer's children or those of other people, and at the first sign of anything being wrong with the milk, such as flakes or clots in it, or of any hardening or swelling of the udder, a veterinary surgeon should be asked to examine the cow.

1. Tuberculosis Mastitis.

This is caused by the presence in the udder of the baccilus of tuberculosis (bovine type). It is a very important form of mastitis because a cow suffering from tuberculosis of the udder gives milk which contains tubercle baccili, and can infect human beings with the disease or if fed to young pigs and calves, infect them. When such milk is sent to a creamery the mixed skim milk is contaminated and thus the calves and pigs of several suppliers to the creamery are liable to be infected through drinking the skim milk. When human beings, chiefly young children, become infected with tuberculosis due to drinking milk contaminated with bovine tubercle baccili, the disease is very often fatal. Tubercular meningitis, tubercular infection of the abdomen, tuberculosis of the glands, bones and joints, are all seen in human beings as the result of drinking raw milk containing bovine tubercle baccili. When the disease in the human being is of the non-fatal type, lameness, deformity or chronic ill-health may remain. It is estimated that in Great Britain about 6 per cent. of all deaths from tuberculosis are due to infection of bovine origin. In Scotland the figure is higher. Of late years the high value of milk as a protective food is being recognised but so also is the danger of drinking raw milk in which the bovine tubercle baccilus is present. Thus it is most important that if a farmer finds one of his cows suffering from any disease of the udder he should seek professional advice, especially if the appearances are as described hereunder. In tuberculosis of the udder or Tuberculous Mastitis the disease may exist for some time without any outward sign and the milk appear normal in every way. Later on a small hard swelling is noticed at some part of the udder, very often in a hind quarter. This swelling is painless. It continues to increase in size and after a time the milk may change in colour and become even greenish-yellow. Only one quarter or the whole udder may be affected. Once a hard painless swelling is noticed in a cow's udder the owner should call in veterinary advice without delay so that samples of the milk may be taken for examination. In fact, all such animals should be reported to the Gardai under the Bovine Tuberculosis Order as suspected of having tuberculosis of the udder. No cow should be kept that has any disease of the udder, her milk sold for human consumption, sent to a creamery, or fed to young calves or pigs, and if an owner acts in this way he may be responsible for causing deaths and much suffering in human beings and serious losses to live stock.

Some authorities say that the vacuum in milking machines should not exceed fifteen inches at the gauge and that if this is exceeded there may be a high incidence of mastitis. The rate of pulsation should not exceed 30 to 35 per minute, that is, 60 to 70 "clicks" per minute. The teat cups should not be left on too long, so that they run up the teats, as the teats may be damaged if this is allowed and anything that damages the teats favours the spread of mastitis. A cow can be trained to give down all her milk in about five minutes. The apparatus controlling the vacuum should be regularly inspected to ensure that it is in good mechanical condition and that the gauge registers accurately.

Maiden heifers are sometimes found affected with this type of mastitis. It is believed that they may become infected as calves by sucking each other after drinking infected milk and this practice should be prevented. Cows that have anything wrong with their udders should on no account be used to rear calves, or to acts as nurses for young bulls.

Finally, in any form of mastitis whenever abnormal milk or secretion is drawn from an udder care should be taken not to permit it to fall on the floor of the cowhouse as, if this is done, infection may be spread to other animals in the herd. All such secretions should be drawn into a vessel and preferably buried. If the floor or bedding becomes contaminated with such discharges the bedding should be burned and the floor cleansed and disinfected.

PRESENT DAY KNOWLEDGE CONCERNING SOME INSECT PESTS OF FARM CROPS

(Lecture delivered at a conference of Agricultural Instructors, 28th Sept., 1944)

by

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This lecture deals primarily with insect pests of farm crops, but I will make some reference to eel worms which I consider of importance. Before I proceed to deal with particular pests I will make some general statements.

The first of these statements is that knowledge about the most important pests of our crops is much more detailed and accurate now than it was, say, a quarter of a century ago. We have now much better knowledge concerning the various species of creatures which are important and about the details of their life history and the manner of their feeding. The possession of such improved knowledge has enabled us to approach with much greater hope of achieving success the problem of dealing with many pests.

In the older days methods were very much more haphazard and confused and knowledge was not at all very accurate.

Insect pests of farm crops fall, roughly, into three categories, namely :—

(1) Those pests that live all the time in the soil and feed entirely on the underground portions of plants :—for example, the well-known wire worms and also such creatures as chafer larvæ, millipedes, etc.

(2) Those which are normal soil dwellers but which come up to the surface of the soil at certain times, say, at night time or at particular seasons of the year, and then damage the crops by feeding at soil level or higher up on the plants :—for example, leather jacket grubs and cutworms :

(3) Those which remain on the overground parts of the plant during the period while they are feeding and damaging the plants. In this category we have, of course, such well-known things as various green flies or aphids, the majority of the common caterpillars and such well-known creatures as flea beetles and the like.

If anybody who has been troubled with pests asks for advice as to how to control these pests, he generally hopes that it will be possible for his adviser to recommend some chemical or toxic substance which will kill them. For that reason, let us see what hope we have of being able to recommend some substance of the kind.

If the pest is in the first category, *i.e.*, if it is one which lives in the soil all the time and damages the underground portion of plants, a chemical could only be used against it by working the substance into the soil so that, being blended with the soil, it may kill the pest by contact or by giving off some toxic vapour. But in this connection I want you to think of the extent to which the substance is diluted by being blended with the soil. The soil from a statute acre of ground of average loamy type, calculating to a depth of 9 inches weighs something between 1,200 and 1,300 tons. Therefore, if we put on, say, a dressing of one ton to the statute acre and work it into the soil the substance becomes diluted to, say, about 1/1250th ; half-a-ton means a dilution of one in 2,500 ; 5 cwts., a dilution of one in 5,000, and 2 cwts., a dilution of one in 12,000.

There are certain chemicals which, if present in the soil at a dilution of one in 2,000 would give an excellent kill of many soil pests. Para-di-chlor-benzene may be given as an example. Some of these chemicals may, indeed, be very effective killers at dilutions as low as one in 5,000 or 1 in 6,000 in the soil, namely, when dressings as low as 4 cwts. or 5 cwts. per statute acre are applied but, unfortunately, there is no efficient substance sufficiently cheap to apply even at the rate of 4 or 5 cwts. per acre. As far as our knowledge goes at present, the only material, which when used as soil dressing, kills a certain proportion of soil pests without the cost being entirely prohibitive, is naphthalene. However, even at peace-time price of naphthalene, a dressing of 5 cwts. per acre would represent an expense about as great as most farm crops could carry and this dressing would probably only kill a proportion of the soil pests against which it is used—perhaps, indeed, even less than 50 per cent. of them in some cases. Naphthalene is, however, about the only substance whose cost may justify its use. I say "may," I do not say "does." A dressing of 10 cwts. per acre of it would not be extravagant in seeking a good kill of soil pests, but probably the cost involved by the use of about 5 cwts. per acre would be the limit, and a dressing under this amount would be of little value against soil pests. Now, that is the position and, unfortunately, it is an unsatisfactory one.

Certain proprietary soil dressings containing naphthalene are on the market and very glowing claims are made for them in advertisements, but, on the whole, these claims are entirely unjustifiable.

From what I have said, you will have gathered that little good can be expected from the use of chemicals against soil-inhabiting pests such as wire worms, etc. It is most likely that the position will, at least for some time to come, remain unchanged in this regard and, consequently, we can only hope to combat these soil-inhabiting pests in some other manner which will most likely be connected with rotation of crops, time of sowing, preparation of the ground, etc.

Within the last few years great strides have been made in the development of various efficient sprays and dusts and fumigating materials to control many pests, but, to a great extent, the pests of vegetation which it is now possible to control by such methods are those of orchard, garden and glass-house. There are not many overground insect pests of farm crops which can be controlled by the use of a spray or dust. The sprays and dusts at present available would be of no use whatever against some of them. Against others some control might be achieved but at an altogether prohibitive cost. There are, however, some pests against which it would be most desirable, perhaps, indeed, absolutely necessary, to use a spray or dust. For example, if the Colorado Potato beetle should, unfortunately, become established in the country the potato haulms would have to be sprayed with a poison spray—with lead arsenate—in order to kill as many as possible of the beetles and their larvae feeding on the haulms. Similarly, if the potato flea beetle should by any chance ever become exceedingly abundant and destructive on potato leaves, spraying with lead arsenate might then also have to be done. If the spraying of potatoes with lead arsenate ever does come into vogue we could, however, mix the lead arsenate with the potato blight spray at present in use and thus secure a dual purpose spray.

A good control of greenfly or aphids on plants can be secured by spraying, preferably with a nicotine spray. Such a practice is an exceedingly common orchard and garden operation and it may be desirable to have recourse to it at times, when dealing with aphids on farm crops, *e.g.*, to combat the aphis or black fly which can become so troublesome on the tips of mangels and beet growing for seed or, similarly, on the stalks of crucifers growing for seed or on the stalks of beans. On the whole, the equipment which we have available here for such spraying of farm crops is not very efficient. For small areas the knapsack sprayer may give reasonably good results, but the horse-drawn barrel sprayer in use here for potato spraying is not a suitable machine for applying a contact-killing spray, such as nicotine spray, to areas of farm crops in an efficient manner.

As a matter of fact, latterly in some countries entirely new improved types of machines have been designed for the application of contact sprays. The

older method was to apply a drenching spray and thus wet the entire plant and all the insects on it. The new machines which I mention deliver the material, not as a visible misty spray, but in such a finely atomised form that it spreads through the plants as an invisible vapour, this vapour being discharged under a cover or canopy which trails on a kind of carriage arrangement behind the machine.

In some drier countries of the world, it has become a practice to put on some insect-killing materials in the form of a dry dust. Such dusting is done in order, in the first place, to get over the difficulty of getting water for extensive spraying operations and, also, because in dry climates the dust remains well on the plants for a length of time. In this country such dusting of farm crops is not likely to become common because, in the first place, the obtaining of water for spray-making is rarely a difficulty and, secondly, the frequent rains and wind which we get here, even in the summer time, would soon remove insecticidal dusts from the plants.

However, for certain purposes and against certain pests dusting gives better control than spraying, *e.g.*, to deal with the pollen beetle which can cause so much damage to the flowers of crucifers growing for seed, the best procedure is to dust with a derris powder dust. Also, before the war, when derris powder was plentiful and relatively cheap, it was practicable to combat flea beetles on seedlings, *e.g.*, the turnip "fly" by application of a derris dust.

We have not, however, in this country machines suitable for application of dusts to farm crops. For putting on a dust close to the ground, *e.g.*, on lines of seedlings relatively simple types of horse-drawn blowers delivering the dust over two or more lines of seedlings are available. For dusting high plants. such as crucifers or mangels gone to seed, a more elaborate machine would have to be used—one which the average farmer would not be likely to own. Such machine has to be mounted on a high carriage. The dust is delivered as a cloud over a wide area and under a trailing canopy so that the cloud of dust may settle to best advantage on the plants without being blown all over the countryside. Some machines of this type are being operated in Britain by firms which do dusting on contract.

There are some pests which it is possible to control by inducing them to eat poison in baits. The most common farm pests which can be thus dealt with are the leather jacket grubs and cut-worm caterpillars. For each of these, Paris Green in bran is the most efficient bait. The more insoluble arsenicals, like lead arsenate, are not nearly so efficient. The very soluble arsenicals, such as the arsenites, would give a good kill but are not desirable because they can

be so easily washed out of the bait material. Unfortunately. Paris Green has become exceedingly scarce here—in fact, it is now almost unprocurable. For certain pests of orchard, garden and glass-house, baits made with Sodium Fluoride or one of the fluosilicates, are commonly recommended, but their use does not extend against farm pests.

In the past we have heard of using deterrents against certain pests, *i.e.*, applying materials whose smell or physical presence will keep certain pests from certain crops. An old recommendation to keep mangel fly off mangels was to spray with paraffin oil emulsion spray. Nowadays our knowledge about deterrents is much more precise. There are certain materials whose smell keeps certain insects away from areas where the material has been applied, but in most cases the effect is short lived. Naphthalene is one of the best deterrents against certain pests, *e.g.*, against the carrot fly, but even its effect rarely lasts for more than a week or ten days and so the application would have to be renewed at weekly intervals. Any deterring effect which paraffin oil emulsion may have, rarely lasts for more than two or three days and, of course, it would be an entirely impracticable business to repeat applications at such frequent intervals to any farm crop. To all intents and purposes, therefore, deterrents have no usefulness in protecting farm crops from insect attack.

These are the main general statements which I wish to make. I will now proceed to make particular statements about some of the more important pests of farm crops, mentioning specially any points which have become known about them during the last few years. I assume in each case that you have some knowledge of the pest in question so that I will not have to go into too great detail about its life-history and habits.

The first creatures I take for mention are some eel worms. Eel worms are very minute, microscopically small, work like creatures which invade plant tissue, and, by burrowing into it, cause various undesirable effects and, sometimes, indeed, the death of the plant. The largest eel worm we have is only about one-tenth of an inch in length in the fully grown or adult condition. The younger forms, or larvae, are very much smaller—about one-hundredth of an inch, so you can understand that these creatures can only be seen by teasing out, under the microscope, the plant tissue in which they occur.

I will first mention an eel worm associated with wheat, I refer to it, not because it is so abundant at the moment, but, as we are now growing wheat very much more extensively, it is a pest which may become much more serious. It is the eel worm which causes the cockle in the ear of wheat. These

little cockles are like hard black beads—lying where the grain should lie—and the presence of a cockle means the absence of a grain of wheat. Sometimes you may only find one or two cockles in an ear, perhaps in a relatively small number of ears in the field, but the position could be much worse. You may find them in most ears and with a great number of cockles in each ear. In that case, the yield would be very much diminished and the grain would be of a very unmillable type on account of the presence of such a preponderance of cockles. It would be definitely unsuitable for human consumption. This eel worm, therefore, is a pest that we must be on the look-out for and on our guard against. The little hard cockles in the ear naturally fall out of the ear when the wheat is being harvested—many fall into the ground. Each cockle contains hundreds of larvæ and when the cockles soften in the ground the larvæ escape and lie there waiting to attack another crop of wheat if such is sown. If a crop of wheat is put down the next year the larvæ are ready to mount the plant, invade the ear and destroy the grain. Definitely, then, if cockle is seen at all in wheat, wheat should not be put into that field the next year. It would be looking for trouble to do so. Wheat containing cockle should, under no circumstances, be offered for sale as seed. If by any chance you are interested in some very special sample of seed wheat—some pedigree sample you particularly want to sow, and which has some cockles in it, you can eliminate these by floating them off in 20 per cent. solution of brine.

The next eel worm I mention is more common and is associated with oats—the stem eel worm. This eel worm is rather specific to oats and occurs in patches here and there in the fields. It gets into the lower regions of the plant when the plant is young, disintegrates the plant and prevents normal growth. The plant becomes twisted, particularly in the underground portion and the condition produced is one usually known as "tulip root" in oats. When that occurs at all it occurs in patches in the field and the patches die out mid-way in the season. Again, if this eel worm should show up in any field it is most desirable not to put oats into such field for two or even three more years because if you do so you are only increasing the eel worm population. This eel worm will not develop in other crops in the intervening years.

The next eel worm is one specific to the potato. It is one which attacks, not the overground portion, but the roots of the potato and it is called the potato root eel worm. By entering the roots and disintegrating them, the plants are not able to make normal growth. They remain very undersized with misshapen stalks and foliage, and die early in the season. This pest is well known in some regions of the country, particularly where potatoes are grown intensively for some years, *e.g.*, the Rush district, the congested districts of the West and in some of the Islands off the West coast, etc. It is also exceedingly abundant and exceedingly important in some market-growing regions in England. Much research has been done on this eel worm

and much has been found out as to how it acts in different circumstances, etc. Unfortunately, however, although we had at times hopes of some control measures, our hopes have not been realised and the only thing we can recommend is not to plant potatoes in ground in which the eel worm has appeared. If you happen to be in a district where there is a danger of this pest getting into the land it is most desirable that potatoes should not be put in such land more than once in every four years. If it shows up in a field it will take at least six years for the infection to die out to such an extent that another fairly satisfactory crop of potatoes can be raised; but putting in potatoes after six years means boosting up any few eel worms that may still remain to a big population again, with the result that you cannot plant any further potato crop for another six years. That is the only control measure that is really available to the practical gardener or farmer in dealing with this pest.

A related strain of root eel worm attacks the roots of sugar-beet—the sugar beet eel worm. This has been a very important pest on the Continent since the middle of the last century and, of course, naturally a great amount of research has been done on it. The position regarding it is much the same as with the potato root eel worm. In order to guard against the possibility of this eel worm coming on to sugar beet it is most desirable not to plant sugar beet more often than once in every four years on the same land. If it does appear at all in sugar beet it would be desirable not to put sugar beet back in the same field again for even eight years. Luckily, there is no record yet of this eel worm in Ireland. Some years ago it was recorded for the first time in Britain and now occurs there to some extent. It is a pest which may make its appearance here sometime and we must be on our guard against it. Other strains of root eel worm occur on such crops as mangels and grain crops, but as yet there are no records of these in Ireland.

The last eel worm I mention is one particularly associated with bulbs. The best-known strain is that which attacks flowering bulbs, but the one I want to mention specifically is the strain which attacks the onion bulb. This strain does occur in the country. It has appeared here and there and if it should become abundant it might be a very serious menace to onion-growing. Again, rotation of onions is most desirable. If you are in a district where the pest is in evidence at all, do not plant onions too frequently on the same soil and most certainly if it appears in a particular field do not put onions back into that field again for some years afterwards. Burn all infected plants, sweepings from onion stores, etc.

I pass from eel worms to some insects and will take first the green flies. Everyone knows, of course, that these well-known insects live by sucking the sap from plants. They are to be found on many plants during the summer-

time, including most farm crops—root crops, mangels, beet, and so on. In later years we have become most concerned with them on these crops when they are running to seed. The principal damage they do is by sucking the sap so extensively that they cause a great drain on the plant and, incidentally, much mal-formation, twisting and curling of the leaves may occur.

Aphids on Potatoes. Here we are not so much concerned with the actual extraction of the sap from the potato foliage. The chief importance of aphids on potatoes lies in the fact that they are transmitters of virus diseases and the whole business of raising virus-free stocks of potatoes means raising these stocks in districts where aphids on potatoes are relatively scarce. This does not mean that they are entirely absent in these districts, but being scarce the chance of their spreading virus diseases is very much reduced. You may occasionally run across a case where aphids are so abundant on potato foliage, and the extraction of sap is so great that you may wish to do something in the way of spraying to lessen them. This spraying would involve the use of nicotine and it could be mixed with the ordinary potato-blight spray if needs be. Normally such spraying is very rarely done.

Any of you who have seen cabbages and other crucifers raised for seed in recent years may have seen a great abundance of aphids on the plants. These aphids are the same species as normally occur on different crucifers. The aphids which you see so abundantly on mangels, beet root, etc., grown for seed are the same species as you find on beans. Mangels, beet and beans are just different summer hosts for the aphis. Other summer hosts are some weeds, particularly docks and thistles. The winter host of this aphis is the spindle tree and it is on the spindle tree that the eggs are hatched out in the spring. It is not until later in the season—in early summer—that you get migration from the winter host to the summer hosts. This migration is just to odd plants here and there in the fields or around the headlands. These plants may be beans, mangels, beet, thistles, docks and so on. Now it is necessary that the aphids on these first odd plants should develop for some time before they spread to the bulk of the plants and so you do not get general infestation of the bulk of the plants until later on in the summer, say, July. The main point, therefore, is to be on the look-out for the first odd plants on which you get the summer generations and to endeavour to eliminate the aphids on these. You may eliminate them by pulling up these odd plants or by nipping of the infested tips and burning them. If the job is too big to do in this manner, you will have to spray and you should spray as efficiently as you possibly can. Give as much drenching spray as will kill all aphids on the first plants of summer hosts. If the job is not thoroughly done and if you omit some plants, particularly weeds, you may get a varying amount of spread to the bulk of the plants later on, and if you do you may have to try and deal

with it by a spraying of the whole crop. In Britain they have latterly been favouring the dusting of areas rather than spraying, but dusting is not possible for us to do so we will probably have to depend on spraying here. Spraying, of course, would apply to all plants liable to be infected, *e.g.*, mangels, beet, etc. Ordinarily, we have not done very much spraying of lower growing crops such as roots for feeding, because to spray these efficiently, particularly the under sides of the leaves, is not by any means an easy matter, and, as a matter of fact, the recompense would not warrant the expense involved.

I will now pass on to wire worms. You know very well the kind of creatures wire worms are and how destructive they can be to the roots of crops. You know that wire worms may be expected to occur under the sod of any grass field but their abundance will vary considerably from field to field. In some fields they may be very scarce or absent; in others more plentiful and in still others abundant. When they occur at all you may expect them to be four different ages, (*viz.*, first year, second year, third year and fourth year ones), because the wire worm takes four years to grow to maturity. When they are four years old they are ready to pupate. When a grass field is broken up for tillage varying numbers of wire worms of the different ages may be found. Normally, of course, the first crop, after breaking up, is a cereal crop and there are some points you should attend to in connection with the breaking up of land, particularly if you know wire worms to be abundant in it. It is advisable to leave the old sod turned down as well as possible and as undisturbed as possible when you put in the first cereal crop, and also, it is desirable to postpone ploughing as long as possible. If a spring cereal is being sown postpone ploughing, preferably well into the new year, the idea being that during the first season the old sod will still be lying underneath and the wire worms will be quite satisfied to remain feeding in it without bothering about the roots of the cereal crops.

During the last few years much data has been collected in regard to the susceptibility of different plants to wire worm damage. It is now known that potatoes and cereals are most susceptible to extensive damage. If wire worms are abundant in land where potatoes are sown, more extensive damage is done to the developing tubers rather than to the roots, so one should avoid, as far as possible, putting potatoes into land which has a big wire worm population. Cereals are also particularly susceptible to damage, principally oats and wheat. Barley is somewhat less susceptible, chiefly because it is put in later and comes away quicker. Fodder crops, such as mangels and turnips, are usually not so severely attacked and may be grown more successfully where cereals and potatoes would be much damaged. Crops still less likely to be severely damaged are those of the cabbage tribe, kales, rape and vetches. Beans are par-

ticularly resistant to wire worm attack and the most resistant crop of all is flax.

Much data has been collected also in regard to the different numbers of wire worms that may cause serious damage. We now know that a population like 100,000 or even 200,000 wire worms to the acre is of little account even where susceptible crops are concerned. When you get up to a population of 300,000 or 400,000 to the acre you will then begin to notice some damage, but generally, not an appreciable amount. When you get up to 500,000 to the acre the damage will be then just so much that you will start thinking about it: but it is not until you get up to a population of 750,000 or 1,000,000 to the acre that you find really serious damage done. Now, a population such as that represents roughly 20 to 30 wire worms to a cubic foot of soil—that is wire worms of all sizes. If there are so many wire worms present you will find perhaps half-a-dozen well grown ones in every couple of spades of soil. It is when you find a population as great as this that you will need to be most painstaking, particularly as regards rotation of crops. The point in regard to late ploughing is important and also leaving the sod undisturbed as much as possible. By the time the second year comes the sod will be gone and the population may still be sufficiently high to cause serious damage. It is in the second year you must withhold the most susceptible crops—potatoes particularly. Do not put in a second crop of cereals if the population is still high. You still have a choice with turnips, mangels, cabbage, kale, rape, vetches, beans, etc., for the second year which is the year in which damage is likely to be heaviest. By the end of the second year theoretically 50 per cent. of the wire worms should have matured and left the soil as beetles, but actually more than half will be gone—many others will have been eaten by birds or will have been killed by tillage operations or frost, so that in most cases by the time the third year comes round, after ploughing up the land, the population is not high enough to cause damage worth thinking about. By the time the fourth year comes the population should be gone down almost to vanishing point. The parent click beetles show little or no incentive to lay eggs on land which is being farmed on the rotation system.

Flea Beetles. Flea beetles, as you know, are small jumping beetles, which attack seedlings coming through the ground. The best-known is the striped "turnip fly" which attacks turnips and other crucifers. There are some entirely black flea beetles which also attack crucifers and a brassy coloured one attacks mangels. There are other flea beetles to be found on bigger plants, principally the potato flea beetle on the foliage of potatoes. We are most concerned with those which attack seedlings. These little flea beetles can ravage seedlings coming through the ground, particularly during spells of warm dry weather.

The damage will be most serious if they settle on the seedlings while they are still in the "seed leaf" condition before they break into rough leaf. The damage then can be so great as to wipe out the seedlings. necessitating re-seeding.

It is most desirable, as everybody knows, to try and avoid "fly" on turnip by sowing the seed as early as possible and, also, by such preparation of the soil and the seed bed as will stimulate quick germination and rapid growth. There have been recommendations in regard to the treatment of seed. We have given some attention to this matter but we have failed to get good results from any system of seed treatment. In recent years a seed treatment consisting of para-di-chlor-benzene and naphthalene dissolved in paraffin oil has been much recommended. We tried out this treatment but failed to find that the claims made for it were justified. Seedlings which are dusted in any way are usually afforded some protection, even when dusted with materials not toxic to the beetles. The mere fact of seedlings being dust covered affords them some protection. Shale dust and cement dust have been used with some degree of success. These are dusts which give protection only to the seedlings without in any way being toxic to the beetles.

A dust with a great degree of toxicity is derris dust, and, as I have said previously, it was sufficiently abundant and usually sufficiently cheap before the war to warrant its use. Undoubtedly, the putting of derris dust on seedlings when they are breaking through the ground could be depended upon to give not alone protection but a kill of the beetles. Unfortunately, derris is off the market at present.

I cannot pass without a brief mention of leather jacket grubs. They will only be found, as a rule, after the breaking up of grassland (the same as wire worms) but they are harmful only to the first crop after lea because the leather jacket grub grows to maturity in one year and then leaves the ground as a "Daddy Long Legs" fly. The farmer encounters them, of course, almost entirely coming to the surface of the ground and cutting off plants of a cereal crop in the night time. The control of leather jacket grubs is quite satisfactory. The use of bran and Paris Green bait gives really good results and it is not necessary to look for a better method of control.

Cut-worm caterpillars do great damage. These caterpillars normally stay in the ground during the day; they come up at night and cut the plants at soil level. They are not encountered very much on cereal crops but they are very destructive to cabbages, lettuces, etc. Bran and Paris Green is again an effective method of controlling them.

I will mention briefly a few small flies which are pests of cereals. The Frit Fly is well known for attacking oats. It is rather specific to the oat. In this case the fly lays its eggs on young oat plants in the spring. A white maggot hatches out from the egg and bores into the central shoot of the plant, thus destroying it. The "tillers" may be attacked and killed as well as the main plant. There is no point which can be made about rotation of crops in regard to Frit Fly because it also breeds on various grasses and, therefore, there is no question of its being confined to particular fields. It is most desirable to sow the oats as early as possible in the season and to do all you can to push on the young oat crop as quickly as possible.

The best way of combating Frit Fly is to have the oat crop as well grown as possible before the pest attacks.

A pest which does damage to wheat very much the same as the Frit Fly does to oats, is the Wheat Bulb Fly. Again, the little maggots invade the young wheat plants, bore into the central shoot and eventually kill the whole plant. This is a fly, however, which is rather peculiar in regard to its laying habits. This fly chooses for preference to lay its eggs in autumn time on bare ground, say, on ground where stubble has been ploughed early, or where potatoes have been lifted early. Eggs may also be laid in a field having a root crop if the foliage of the plants does not give full cover of the ground.

If you are in a district where the Wheat Bulb Fly is found you may expect it particularly in fields that have been attractive for egg laying the previous autumn. This is a thing you cannot do very much about except to try and avoid having a field which is intended for wheat the next year being in this bare condition suitable for egg-laying in the autumn.

The third pest is the "Gout Fly," which is specific, almost entirely, to barley. This is a fly which does not lay its eggs until the season is fairly well advanced. It lays its eggs on the barley plants, usually fairly high up. A maggot hatches out which enters the shoot and starts boring down but it stops boring when it comes to a node and by feeding at such spot causes the plant to become swollen and gouty—hence comes the name, "Gout Fly." If barley is backward and late the fly may lay while the plants are still fairly low and then this swollen, gouty condition will be fairly close to the ground and the plants that develop such condition very often become very poor and fail to grow up. A more usual condition, however, is for the plants to be fairly well run up before the fly lays. As a matter of fact, if barley has come away quickly and early the ears may have shot out before the eggs are laid. If the ear is still in the sheath when the eggs are laid the maggot will bore down the side of the ear and by doing so it strips the grain off that side of the ear. The result is

that when such ear afterwards breaks out of the sheath you will have an ear with grains on one side only. Not much can be done against this pest. The main thing again is to try and secure earliness, to have the crop coming away quickly and, if possible, to have it so early that it will have shot out before the normal time for egg-laying.

I will finish with a very brief reference to the Mangel Fly, which, as you know, may be found in odd years on mangels and beet. The fly lays its eggs on the under sides of the leaves and the maggots later burrow in the leaves. I mentioned earlier on the old-fashioned recommendation of paraffin spray as being of no value. You will understand that the smaller the plant is and the fewer the leaves it possesses when attacked by the maggots the more serious is the damage likely to be—if there are only a few small leaves the plant may be killed completely. If, on the other hand, the plant is well grown, then there are so many leaves that it can stand a fairly good amount of leaf damage without such serious consequence. The thing, therefore, to aim at is earliness of sowing and doing everything possible to push on the young plants into rapid growth.

I think I have mentioned the more important pests. There are many which I have not mentioned as the time does not allow me to do so, but I would like to finish up on this note :—In recent years we have become more and more alive to the fact that many natural agencies are of very great help to us in keeping down insect pests. Some years ago we did not think very much about the efficiency of birds ; we did not think of the effectiveness of things like Ladybird Beetles and different parasites which attack various insect pests. Now we know very well that all these creatures which attack pests help us very much indeed in the fight against pests and, were it not for the activity of predatory insects and the different parasites which attack all the different pests we would have these pests in very great abundance every year. As it is, these pests, some of which I have mentioned, occur not every year, but at intervals and in sporadic fashion and, to a great extent, this is due to the controlling forces of Nature.

REPORT OF THE SEED PROPAGATION DIVISION, 1944

WEATHER CONDITIONS.

The period covered by this report was one of extreme weather conditions. From the 1st November, 1943 to 31st March, 1944, the total rainfall was 9½ inches less than normal, there was a complete absence of rain from the 4th February to the 1st April, 1944. Though the April rainfall was 3.27 inches, a further drought lasted from the 18th April to the 26th June and the May-June rainfall was 2.64 inches less than normal. As was to be expected, July, September, October and November were very wet and the rainfall for these four months amounted to 22.71 inches or 9.27 inches more than the normal figure.

November and December, 1943, were cold and dry and provided excellent conditions for winter cultivations; fine mild weather in January and early February was followed by a hard, frosty spell making land difficult to work. The driest March ever recorded gave brilliant sunshine, and ground frosts at night; land became caked and lumpy. Rain and hot sunshine in early April brought good growing conditions, but from the latter half of the month, drought, harsh drying winds and sunshine prevailed until the end of June and grass land and corn crops, which at first grew well, stood still and then wilted. Hay was very scarce and roots received a severe set back. July was warm, rainy and sunless and stimulated luxuriant growth. The harvest was very early and the first three weeks of August brought good conditions, but on the 22nd the weather broke and remained wild and exceedingly difficult throughout September, October was cold and wild and November brought bitterly cold weather with strong winds reaching gale force on seven days and very heavy rainfall amounting to 6.67 inches.

As in previous years the bulk of the barley propagations and other investigational work was carried out at the Cereal Station, Ballinacurra, Co. Cork, in close collaboration with Messrs. A. Guinness, Son & Co. Ltd., at whose Experimental Maltings the malting tests were conducted. The work consisted of the usual pure line propagations, large scale variety, half-drill strip and other experiments.

Pure line propagations of Red Marvel and April Red Bearded Wheats and Black Tartary oats were maintained at the Cereal Station and extension

plots of Red Marvel Wheat, Victory II and Ardri Oats were grown in the neighbourhood of Ballinacurra.

BARLEY.

The method adopted in 1929 in the selection of Spratt-Archer 37, No. 3 was again adopted in the selection of Spratt-Archer 37, No. 3 and Spratt-Archer 37, No. 4. This method consists of sowing five grains from every fifth plant of a single line in the preceding year. The pure line is thus composed of twenty-five five-grain lines. Each of the other varieties was propagated by taking the requisite amount of seed from the single line grown in 1943.

In addition to the pure lines mentioned above, forty-six single plant selections were grown in the old Cage at the Cereal Station, Ballinacurra. These were as follows:—

Spratt-Archer 37/6, Spratt-Archer 37/6 No. 7, Spratt-Archer 37 No. 4 (five grains from each of twenty-five plants), Spratt-Archer 37/6/3, Archer Goldthorpe 4/5/1, Spratt, Archer, Goldthorpe, Old Irish, Burton Malting, Victory, D.S.K. Binder, Plumage Archer, Plumage, Hybrid No. 7, Black Himalayan, Abed Kenia, Kenia, Naked Barley, Golden Archer 1, Golden Archer 2, Gold, Goldberg, Goldberg 2, Spratt-Archer 37 No. 3 x Victory 1, Spratt-Archer 37 No. 3 x Victory 2, Glabron, Pearl, Donegal Six-Rowed, July Six-Rowed, Beaven's F112, Beaven's 49/14/3, B244, Spratt-Archer 37 No. 3 H.9 x Golden Archer 2, No. $\frac{1}{1}$, Spratt-Archer 37 No. 3 H. 9 x Golden Archer 2 No. $\frac{1}{2}$, Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 2, Spratt-Archer 37 No. 3 H.9. x Hybrid 4 B1 No. 1, Spratt-Archer 37/9 x Golden Archer 2 No. 1, Spratt-Archer 37/9 x Golden Archer 2 No. 2, Maja, Beaven's 54/12/3, Camton, Pioneer, Hordeum Deficiens No. 16, F3 Hordeum Deficiens No. 16 x Irish Archer, Beaven's 57/8.

Garden, Field and First pedigree plots as follows were grown on the farm of John H. Bennett, Ltd., Ballinacurra :

GARDEN PLOTS

Spratt-Archer 37 No. 3 (25 lines)
Spratt-Archer 37 No. 3, Selection No. 7.
D.S.K. Binder.
Golden Archer 2.
Spratt-Archer 37 No. 3 x Victory 1.
Spratt-Archer 37 No. 3 x Victory 2.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{1}$.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{2}$.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 2.

Spratt-Archer 37/9 x Golden Archer 2 No. 1.
Spratt-Archer 37/9 x Golden Archer 2 No. 2.
Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 1.
Beaven's 54/12/3.
Kenia x Spratt-Archer F.2.
Spratt-Archer x Spratt F.2.
Spratt-Archer x Archer F.2.
Spratt x Archer F.2.
Spratt x Archer F.3.
Spratt-Archer 37/6/3.
Beaven's 57/8.
Camton.
Pioneer.

FIELD PLOTS.

Spratt-Archer 37 No. 3.
Spratt-Archer 37 No. 3 Selection No. 7.
Spratt-Archer 37 No. 3 x Victory 1.
Spratt-Archer 37 No. 3 x Victory 2.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{1}$.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{2}$.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 2.
Spratt-Archer 37/9 x Golden Archer 2 No. 1.
Spratt-Archer 37/9 x Golden Archer 2 No. 2.
Spratt x Archer F.3.
Spratt-Archer 37 No. 3 H. 9 x Hybrid 4 B.1 No. 1.
Beaven's 54/12/3.
D.S.K. Binder.

FIRST PEDIGREE PLOTS.

Spratt-Archer 37 No. 3.	...	4 acres.
Spratt-Archer 37 No. 3 x Golden Archer 2 No. $\frac{1}{1}$	...	1 acre
Spratt-Archer 37 No. 3 x Hybrid 4 B.1. No. 1.	...	1 ,,
Spratt-Archer 37 No. 3 x Golden Archer 2 No. $\frac{1}{2}$.	...	1 ,,
D.S.K. Binder	...	$\frac{1}{2}$,,
Beaven's 54/12/3.	...	1 ,,

The produce of these plots will be available in 1945 for further propagation and Large Scale Variety Experiments.

Second Pedigree plots with following quantities of seed of Spratt-Archer 37 No. 3 were grown under contract with the following farmers in the neighbourhood of Ballinacurra :—

	Brls.	*Sts.*
M. Kelleher, Geragh, Ballinacurra	4	11
P. McCarthy, Castleredmond, Ballinacurra	4	0
R. Barry, Broomfield, Midleton	5	8
J. O'Reilly, Ballinabointra, Carrigtwohill	3	6
Wm. Tait, Buckstown, Rostellan	12	11
	30	4

The produce of these plots will be available for distribution as nucleus stock of pedigree seed in the Spring of 1945.

For a number of years the Department has had in operation a scheme under which nucleus stocks of Pedigree Spratt-Archer barley are distributed each year to members of the Irish Maltsters' Association and others interested in seed barley distribution. Those who obtain such stocks undertake to have them grown with reliable farmers ; to buy the produce if suitable for seed purposes, and to distribute it to growers in the following season. Under the Scheme 390 barrels of pedigree Spratt-Archer 37 No. 3 were distributed to the following :—

	Brl.	*Sts.*
Messrs. Minch, Norton & Co., Ltd., Athy	50	—
Messrs. Minch, Norton & Co., Ltd., Nenagh	20	—
Messrs. Minch, Norton & Co., Ltd., Bagenalstown ..	15	—
Messrs. Minch, Norton & Co., Ltd., Barracore ..	15	—
Messrs. Minch, Norton & Co., Ltd., Stradbally ..	20	—
Messrs. N. Hardy & Co., Ltd., 72, Park Street, Dundalk	10	—
Messrs. P. O'Meara & Sons, Ltd., Thurles	10	—
Messrs. Cairnes, Ltd., Drogheda	10	—
Messrs. J. Bolger & Co., Ltd., Ferns, Co. Wexford ..	10	—
Messrs. Birr Maltings, Ltd., Birr	10	—
Messrs. Beamish & Crawford, Cork	5	—
Messrs. P. J. Roche & Sons, Ltd., New Ross ..	10	—
Messrs. Murphy Bros. (Rathangan) Ltd.	10	—
Messrs. J. H. Bennett, Ltd., Ballinacurra, Co. Cork ..	10	—
Messrs. F. A. Waller & Co., Ltd., Banagher ..	10	—
Messrs. George Read & Co., Roscrea	14	—
Messrs. Joshua Watson & Co., Ltd., Carlow ..	20	—

Messrs. Joshua Watson & Co., Ltd., Leighlinbridge ..	10	—
Messrs. W. J. O'Keeffe & Sons, Wexford	10	—
Messrs. D. E. Williams, Ltd., Tullamore	35	—
Messrs. P. & H. Egan, Ltd., Tullamore	20	—
Messrs. J. & A. Tarleton, Ltd., Tullamore	10	—
Messrs. R. Gibney & Co., Ltd., Portlaoighise ..	10	—
A. J. M. Reeves, Athgarvan Maltings, Co. Kildare ..	4	—
The North Tipperary Maltings, Ltd., Nenagh ..	12	—
Messrs. Latchford & Sons, Ltd., Tralee	10	—
Messrs. P. J. Roche & Sons, Enniscorthy, Co. Wexford	10	—
Messrs. R. Perry & Sons, Ltd., Rathdowney ..	10	—
	390	—

In addition to the above the following quantities of seed barley were also distributed :—

	Brls.	*Sts.*
D.S.K. Binder		
To the Agricultural School, Athenry, Co. Galway ..	7	4
July Six-Rowed		
To the Agricultural School, Athenry, Co. Galway ..	11	15

INSPECTION OF GROWING CROPS FOR SEED PURPOSES.

In order that those who co-operate in the scheme for the distribution of Pedigree Spratt-Archer seed might have information regarding the suitability of the produce for seed purposes, the Department arranged to have the crops which were grown for this purpose inspected by the Agricultural Instructors before harvest. For inspection purposes the crops were divided into three classes: (1) Crops grown from seed which was obtained from Ballinacurra in 1944. (2) Crops grown from seed which was the produce of seed obtained from Ballinacurra in 1943 and (3) Crops grown from Commercial seed of Spratt-Archer 37 No. 3. As regards (3) inspections were only made in those cases where the maltsters concerned were of opinion that they would not have sufficient seed otherwise and so required inspections made of the most promising crops grown from Commercial stocks.

A total of 6113 statute acres was inspected, of which 5286 acres were reported as likely to produce grain suitable for seed purposes if properly

harvested. Of the 565 acres inspected under category (1) 24 acres or 4.2% were rejected because of smut or an undue admixture of wheat, oats or other barley.

In category (2) 3517 acres were inspected and 505 acres or 14.4% were rejected. The rejections were chiefly due to other barleys having been sown in the same field, poor crops, smut and the presence of an undue amount of oats and wheat. Under category (3) 2013 acres were inspected and 298 acres or 14.7% were rejected for the same causes as in category (2).

From the number of crops rejected it is apparent that some distributors did not take sufficient care in the selection of growers and in having the seed properly treated with a fungicidal dressing before it was despatched to growers. It is desirable that firms co-operating in this scheme should exercise care in selecting growers and in treating the seed with a suitable powder dressing before it is despatched to them.

LARGE SCALE BARLEY VARIETY EXPERIMENTS.

These experiments were carried out at ten centres in seven counties, one in each of Counties Cork, Tipperary, Kilkenny, Kildare and Louth, two in Offaly and three in Wexford. The seeds used for the experiments was the produce of the first Pedigree plots established at the Cereal Station, Ballinacurra, Co. Cork in 1943. The area of the plots throughout was one statute acre. All the seed was dressed with Agrosan powder at the rate of 8 ozs. per barrel of seed. The three varieties sown at all centres were Spratt-Archer 37 No. 3, Spratt-Archer 37 No. 3 x Victory 2 and Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 2.

Sowing conditions were favourable and all plots were sown by the 11th April.

At all centres the seed germinated well and at the end of May there was a good braird on all plots. There was no lodging and although growth was slow owing to the abnormal drought, yields were satisfactory but quality was not as good as usual.

The names and addresses of the growers, the nature of the soil and subsoil, the crops grown in the two previous years and the dates of sowing and harvesting are set out in Table I. In each case the first mentioned date of harvesting was that of Spratt-Archer 37 No. 3 x Victory 2.

In Table II are set out the weights of grain per statute acre, the commercial value of the grain as determined by independent valuers, and the total

value of the grain including screenings which were valued at 6d. per stone. The values thus determined are not those which would have been obtained in the season 1944 during which the price of barley was fixed at 35/- per barrel, but they were based on an arbitrary price range closely related to the fixed price.

Spratt-Archer 37 No. 3 had the highest average yield and was significantly higher than Spratt-Archer 37 No. 3 x Victory 2. In nitrogen per cent. Spratt-Archer 37 No. 3 was significantly lower than either of the other varieties. The nitrogen contents of the barleys grown on the Kildare and Kilkenny plots were very high, those of the latter being the highest yet recorded in these experiments.

TABLE I.

Large Scale Barley Variety Experiments, 1944.

Centre No.	Name and Address of Grower	Description of Soil	Previous Crops	Date of Sowing	Date of Harvesting
1	Wm. Tait, Rostellan, Co. Cork ...	Medium Loam, Sub-soil, Shale	1942 Wheat 1943 Beet	25/3/44	8/8/44 14/8/44
2	P. Byrne, Ballygrangans, Co. Wexford	Sandy Loam, Sub-soil, Gravel	1942 Barley 1943 Beet	5/4/44	17/8/44 26/8/44
3	D. Morris, Tomahurra, Enniscorthy	Shale Loam, Sub-soil Shale	1942 Barley 1943 Roots	24/3/44	21/8/44 31/8/44
4	Mrs. Segrave, Dunany, Dunleer ...	Strong loam Sub-soil Gravel	1942 Wheat 1943 Roots	20/3/44	23/8/44 30/8/44
5	M. Howlett, Ransgrange, Wexford	Stiff Loam Sub-soil, Shale	1942 Wheat 1943 Beet	31/3/44	14/8/44 20/8/44
6	M. P. Minch, Rockfield, Athy ...	Deep Loam Sub-soil, Gravel	1942 Wheat 1943 Barley	22/3/44	16/8/44 18/8/44
7	Wm. Mullins, Duninga House, Goresbridge	Strong Loam Gravel, Limestone	1942 Grass 1943 Wheat	6/4/44	24/8/44 26/8/44
8	D. O'Brien, Ballinamere, Tullamore ...	Gravelly Loam Sub-soil, Limestone	1942 Roots 1943 Wheat	7/4/44	12/8/44 16/8/44
9	E. P. Rutledge, Ballyeighin, Birr ...	Light Loam Sub-soil, Limestone	1942 Roots 1943 Wheat	11/4/44	22/8/44
10	M. Carroll, Belleen, Nenagh	Strong Loam Sub-soil, Limestone	1942 Hay 1943 Hay	23/3/44	18/8/44 20/8/44

TABLE II.

Large Scale Barley Variety Experiments, 1944. Yield and Value of Grain per Statute Acre

CENTRE	SPRATT-ARCHER 37 No. 3. Yield of Dressed Grain	Yield of Screenings	Value per Barrel	*Total Value Including Screenings	SPRATT-ARCHER 37 No. 3 x VICTORY II. Yield of Dressed Grain	Yield of Screenings	Value per Barrel	*Total Value including Screenings	SPRATT-ARCHER 37 No. 3 H.9 x GOLDEN ARCHER 2 No. 2 Yield of Dressed Grain	Yield of Screenings	Value per Barrel	*Total Value including Screenings
	Brls. Sts	Sts.	s. d	£ s. d.	Brls. Sts.	Sts.	s. d.	£ s. d.	Brls. Sts.	Sts.	s. d.	£ s. d.
Cork: Wm. Tait	16 15	5	34 9	29 11 1	15 13	5	34 6½	27 8 8	15 8	4	34 6½	26 17 5
Tipperary: M. O'Carroll	10 8	4	34 11	18 8 7	10 9	3.5	34 6½	18 6 7	10 7	4	34 7¼	18 3 5
Offaly: E. P. Ruttledge ...	10 15	5	34 6	18 19 10	11 6	4.5	34 5½	19 14 3	11 7	4.5	34 7½	10 18 3
D. O'Brien	8 7	4	34 4	14 11 8½	9 6	4	34 2½	16 2 9	8 6	4	34 3½	14 9 2
Kildare: M. P. Minch	14 2	4.5	34 0½	24 3 1	13 12	3.5	34 2	23 11 6	14 7	4	34 2	24 15 3
Kilkenny: W. Mullins	9 6	6.5	34 2	16 3 7	8 12	4	34 1½	15 0 7	9 9	6.5	34 0½	16 8 9
Wexford: M. Howlett	16 1	5	35 0	28 4 8	15 4	4	34 8	26 10 8	15 3	4	34 8	27 10 3
P. Byrne	12 2	3.5	34 8	21 2 1	8 6	4	34 3	14 8 10	10 7	3.5	34 4½	18 0 7
D. Morris	10 8	3	34 8½	18 5 11	8 5	2.5	34 2	14 5 3	9 1	3	34 6½	15 14 8
Louth: Mrs. Segrave	16 11	2	34 8½	28 15 4	14 12	3	34 5	25 9 2	14 12	1	34 3	25 5 8
TOTAL:	125 11	42.5	34 5	218 5 10	116 5	38	—	200 18 3	119 13	33.5	—	207 3 2
AVERAGE:	12 9.1	4.25	34 6¼	21 16 7	11 10.1	3.8	34 4½	20 1 10	11 15.7	3.35	34 5	20 14 4

*Screenings valued at 6d. per stone

TABLE III.

Large Scale Variety Experiments, 1944. Analysis of Produce.

GROWER	SPRATT-ARCHER 37 No. 3				SPRATT-ARCHER 37 No. 3 x VICTORY II				SPRATT-ARCHER 37 No. 3 H.9 x GOLDEN ARCHER 2 No. 2.			
			ON DRY MATTER				ON DRY MATTER				ON DRY MATTER	
	Bushel Weight lb.	Moisture %	Weight of 1,000 Corns grms.	Nitrogen %	Bushel Weight lb.	Moisture %	Weight of 1,000 Corns grms.	Nitrogen %	Bushel Weight lb.	Moisture %	Weight of 1,000 Corns grms.	Nitrogen %
Wm. Tait	55.6	17.4	38.4	1.82	55.9	18.1	39.0	1.82	55.7	17.5	39.2	1.86
M. Carroll	53.2	18.6	36.0	1.41	52.6	17.1	37.5	1.44	52.4	17.6	36.2	1.50
E. P. Ruttledge	54.4	17.6	36.6	1.40	53.4	18.2	37.1	1.52	51.4	17.4	37.7	1.51
D. O'Brien	50.7	13.0	30.6	1.28	51.2	18.6	31.2	1.36	51.6	17.8	31.5	1.36
M. P. Minch	51.6	19.4	35.5	2.04	52.0	18.8	36.0	2.10	52.3	18.4	35.4	2.08
W. Mullins	52.1	20.0	39.4	2.52	51.8	20.0	40.1	2.60	51.4	20.2	38.2	2.55
M. Howlett	53.1	18.1	36.9	1.38	52.8	18.6	38.9	1.47	52.6	18.2	38.5	1.36
P. Byrne	54.2	18.4	35.2	1.50	52.6	19.3	31.6	1.81	53.4	18.6	35.0	1.65
D. Morris	52.0	18.6	34.0	1.68	51.4	21.2	34.2	1.76	52.1	19.0	34.8	1.80
Mrs. Segrave	55.2	19.6	37.9	1.76	55.0	19.4	39.1	2.03	54.9	19.4	38.4	1.96
TOTAL	532.7	185.7	360.5	16.79	528.7	189.6	371.9	17.91	530.8	184.1	364.9	17.63
AVERAGE	53.27	18.57	36.05	1.697	52.87	18.96	37.19	1.791	53.08	18.41	36.49	1.763

HALF DRILL STRIP EXPERIMENTS.

Three of these experiments were carried out on the farm of Messrs. J. H. Bennett, Ltd. Each trial consisted of twenty-two strips of each variety under test, a strip being half the width of the corn drill. To ensure even sowing the seed in each half of the corn drill was changed over for the sowing of the second half of the experiment. In order to maintain the sequence of the strips, the machine was driven up the field idle before commencing to sow the second half of the experiment.

In No. 1 experiment the produce of the 1943 field plot of Spratt-Archer 37 No. 3 was tested against the produce of the second pedigree plot of the same variety, the object being to ascertain if the younger generation was maintaining the desirable qualities of the older generation. The results which are set out in Table IV. show that the difference in yield between the two generations was insignificant.

In No. 2 experiment Spratt-Archer 37 No. 3 was tested against Beaven's 54/12/3 a broad eared variety obtained by crossing Spratt-Archer and Plumage Archer. The results which are set out in Table IV. show a slight but significant difference in yield in favour of Beaven's 54/12/3.

In No. 3 Experiment Spratt-Archer 37 No. 3 was tested against a broad eared selection from the cross Spratt-Archer 37 No. 3 H.9 x Hybrid 4B1. The results which are set out in Table IV show that the latter was significantly inferior to Spratt-Archer.

TABLE IV.

Half-Drill Strip Experiments, 1944.

	No. 1 Exp.						No. 2 Exp.						No. 3 Exp.					
	Spratt-Archer 37 No. 3						Spratt-Archer 37 No. 3			Beaven's 54/12/3			Spratt-Archer 37 No. 3.			Spratt-Archer No. 3 H9 x Hybrid 4 B.1, No.1		
	Field Plot			2nd Pedigree														
		Sts.	lb.		Sts.	lb.		Sts.	lb.		Sts.	lb.		Sts.	lb.		Sts.	lb.
	A	2	7	B	3	0	a	2	11	B	2	8	a	3	3	B	3	0
	C	3	2	b	3	1	C	2	9	b	2	8	C	3	3	b	3	2
	c	3	6	D	3	5	c	2	0	D	2	5	c	3	8	D	3	1
	E	3	6	d	3	6	E	2	0	d	2	7	E	3	1	d	3	1
	e	3	9	F	3	13	e	2	1	F	2	1	e	3	2	F	3	0
	G	2	12	f	2	7	G	2	0	f	2	2	G	3	2	f	3	4
	g	3	0	H	2	11	g	2	2	H	2	3	g	3	3	H	3	2
	I	2	9	h	2	12	I	2	7	h	2	8	I	3	7	h	3	7
	i	2	12	J	2	12	i	2	8	J	2	12	i	3	8	J	3	6
	K	2	13	j	2	12	K	3	0	j	3	1	K	3	6	j	3	6
	k	3	1	L	3	1	k	3	1	L	3	5	k	3	7	L	3	2
	M	3	3	l	3	4	M	3	4	l	3	8	M	3	5	l	3	4
	m	3	1	N	3	2	m	3	4	N	3	8	m	3	1	N	3	1
	P	3	1	n	3	2	P	3	9	n	3	9	P	3	2	n	3	6
	p	3	3	Q	3	2	p	3	10	Q	3	10	p	3	2	Q	2	12
	R	2	13	q	3	1	R	3	10	q	3	7	R	2	10	q	3	0
	r	3	1	S	2	13	r	4	0	S	3	11	r	2	11	S	2	11
	T	3	3	s	3	2	T	3	7	s	3	10	T	2	12	s	2	11
	t	3	4	V	3	0	t	3	12	V	3	10	t	2	12	V	2	7
	W	2	13	v	3	2	W	3	6	v	3	0	W	2	11	v	2	7
	w	2	12	X	3	0	w	3	10	X	3	7	w	2	9	X	2	11
	Y	2	13	x	2	13	Y	3	5	x	3	6	Y	3	3	x	2	4
Total		67	4		68	4		66	4		67	13		68	2		66	7
Average		42.8			43.5			42.2			43.2			43.4			42.3	
Average Moisture %		17.4			17.9			17.3			17.8			17.0			17.2	
*Average Nitrogen %		1.62			1.60			1.61			1.48			1.65			1.50	
*Average Weight of 1,000 corn (grms)		35.6			34.8			34.3			35.8			34.8			37.5	
Relative Malting Quality ...		100.0			98.6			100.0			99.3			100.0			101.1	

*On dry matter

SMALL SCALE QUANTITATIVE EXPERIMENT, 1944.

This experiment was conducted in the old cage at the Cereal Station. Eight varieties were sown in a series of randomised blocks, there being fourteen replicas of each variety.

The varieties included were :—

Spratt-Archer 37 No. 3.
Spratt-Archer 37 No. 3, Selection No. 7.
Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 1.
Beaven's 54/12/3.
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{1}$
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. $\frac{1}{2}$
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 2.
Spratt-Archer 37/9 x Golden Archer 2 No. 2.

The results are set out in Table V.

All the yields are very low. The first two varieties in the Table gave yields significantly higher than the average yield, and the last two gave yields significantly lower than the average. The Malting quality of the barleys varied almost directly with the yields.

TABLE V.

Small Scale Quantitative Experiment, 1944

Average of Fifteen Plots

Variety	No. of Plants	No. of Ears	Ear Weight	Grain Weight	Nitrogen %*	*Weight of 1,000 corns	Relative Malting Quality
Spratt-Archer 37 No. 3 H.9 x Golden Archer No. 2 ...	88.3	188.1	174.8	150.6	1.64	34.8	100.5
Beaven's 54/12/3	95.3	180.9	169.8	149.3	1.54	34.2	101.7
Spratt-Archer 37/9 x Golden Archer 2 No. 2 ...	81.1	169.1	162.5	141.4	1.68	33.8	101.4
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. ½	88.4	192.1	165.9	140.2	1.76	34.0	100.8
Spratt-Archer 37 No. 3 Selection No. 7	82.2	172.6	159.2	138.3	1.66	34.4	100.5
Spratt-Archer 37 No. 3	91.7	177.7	153.6	133.7	1.69	32.9	100.0
Spratt-Archer 37 No. 3 H.9 x Hybrid 4 B.1 No. 1 ...	89.8	155.7	145.9	125.5	1.67	35.0	98.4
Spratt-Archer 37 No. 3 H.9 x Golden Archer 2 No. 1	72 4	157.8	141.9	122.5	1.76	32.2	98.2

*on dry matter

OATS.

Pure Line :—A single plant selection and a garden plot of Black Tartary Oats were grown at the Cereal Station in order to retain a pure line stock of this variety.

DEPARTMENT'S EXTENSION PLOTS.

In order to have available stocks of Pedigree seed oats for merchants and others interested in the distribution of Pedigree seed, stocks of Ardri and Victory II oats were grown under agreement with selected farmers in the neighbourhood of Ballinacurra. These stocks were grown, harvested and threshed under the Department's supervision. The produce was kiln-dried, cleaned and made available for distribution in the Spring of 1945.

The following are the names and addresses of growers, together with the acreages and amounts of seed sown :—.

ARDRI	Acres	Brls.	Sts.
*Wm. Tait, Buckstown, Rostellan, Co Cork	7	8	0
*J. Hegarty, Ballinbeg, Rostellan, Co. Cork	4	4	8
*P. O'Keeffe, Ardra, Rostellan, Co. Cork	4	4	8
*J. Barter, Inchiquin, Killeagh, Co. Cork	10	11	6
*S. Nortridge, Ballymacsliney, Midleton	5	5	10
*C. Garde, Inch, Whitegate, Co, Cork	5	5	10
	35	40	—

VICTORY II	Acres	Brls.	Sts.
*Wm. Tait, Hermitage, Rostellan, Co. Cork	14	16	0
R. Scanlon, Geragh, Ballinacurra, Co. Cork	4	4	8
Mrs. Bourke, Ballintotas, Midleton, Co. Cork	5	5	10
J. Tait, Inch, Whitegate, Co. Cork	12	13	10
	35	40	—

*The seed sown at these centres was obtained from the Albert Agricultural College, Glasnevin, Dublin.

SCHEME FOR THE DISTRIBUTION OF PEDIGREE STOCKS OF SEED OATS.

Under the Department's Scheme nucleus stocks of Pedigree Victory II, Ardri and Potato Ardee which were propagated in the Ballinacurra district in 1943 were distributed to Seed Merchants and others in the Spring of 1944.

These Pedigree stocks were supplied to merchants on condition that they would undertake to have the seed grown by reliable farmers, to purchase the produce, if suitable, and to retain it for seed purposes. In order to facilitate merchants, the Department arranged for the inspection by the Agricultural Instructors of the growing crops. Reports received at the end of the season, 1944, indicated that in practically all cases the crops grown from the Pedigree seed were likely to produce grain suitable for seed purposes. Consequently, merchants who participated in this Scheme and who took sufficient care in the selection of growers and in the subsequent handling of the produce, have large stocks of high-class home-grown seed oats available for sowing in the Spring of 1945.

Under the above Scheme, foundation stocks of Pedigree seed Oats were supplied to the following in 1944.

POTATO ARDEE.

The Superintendent, Agricultural School, Athenry, Co. Galway.

ARDRI.

The Superintendent, Agricultural School, Athenry, Co. Galway.
The Superintendent, Agricultural School, Clonakilty, Co. Cork.
Messrs. M. Kelleher & Sons, Ltd., Tralee, Co. Kerry.
The Universal Providing Stores, Edenderry.
Messrs. Latchford & Sons, Ltd., Tralee.
Messrs. E. Dowley & Sons, Ltd., Carrick-on-Suir, Co. Tipperary.
Messrs. J. H. Roche & Sons, Ltd., William St., Limerick.
Messrs. D. E. Williams, Ltd., Tullamore, Offaly.
Messrs. Suttons Ltd., 1, South Mall, Cork.
Messrs. J. H. Bennett, Ltd., The Maltings, Ballinacurra, Co. Cork.
Messrs. C. F. Bellew, Ltd., Drogheda, Co. Louth.
Messrs. R. McCowen & Sons, Ltd., Tralee.
Messrs. John P. Hopkins & Sons, Ltd., Wicklow.
Messrs. D. O'Connor, Ltd., Upper William Street, Limerick.
Mr. J. Cunningham, Ballacolla, Leix.
Messrs. P. &. H. Egan, Ltd., Tullamore.
Messrs. E. & F. McLysaght, Ltd., Hazelwood, Mallow.
The Donaghmore Co-Op. Creamery, Ltd., Ballybrophy, Leix.
Messrs. Wm. Power & Co., 25-26. O'Connell Street, Waterford.
Messrs. North Offaly Co-Op. Agricultural Society, Ltd., Tullamore.
Messrs. Shelbourne Co-Op. Agricultural Society, Ltd., Campile, Co. Wexford.
Messrs. The Mitchelstown Co-Op. Agricultural Society, Ltd.
Messrs. J. Callaghan & Son, Glanworth, Co. Cork.
Mr. J. Fitzgerald, Drumcollogher, Charleville, Co. Cork.
Mr. W. J. O'Callaghan, Longueville, Mallow.
Mr. William Bland, Rath House, Portarlington.
Captain H. M. S. Redmond, Popefield, Athy, Co. Kildare.
Mr. R. Lahiffe, Cloon House, Gort, Co. Galway.
Mr. P. Cleary, Springfield, Clerihan, Cahir, Co. Tipperary.

VICTORY II.

The Superintendent, Agricultural School, Athenry, Co. Galway.
The Superintendent, Agricultural School, Ballyhaise, Co Cavan.
The Superintendent, Agricultural School, Clonakilty, Co. Cork.
Messrs. M. Kelleher & Sons, Ltd., Tralee, Co. Kerry.
Messrs. J. Callaghan & Sons, Glanworth, Co. Cork.
Messrs. H. Good, Ltd., Kinsale, Co. Cork.
Messr. J. H. Bennett, Ltd., Ballinacurra, Co. Cork.
Messrs. McKenzie, Camden Quay, Cork.

The Universal Providing Stores, Edenderry, Offaly.
Messrs. E. Dowley & Sons, Ltd., Carrick-on Suir, Co. Tipperary.
Messrs. John P. Hopkins & Sons, Ltd., Wicklow.
Messrs. E. Morrin & Son, Ltd., Baltinglass, Co. Wicklow.
Messrs. D. E. Williams, Ltd., Tullamore, Offaly.
Messrs. W. A. & A. F. Woods, Ltd., Castle Street, Sligo.
Messrs. Traynor (Wexford), Ltd., Wexford.
Messrs. E. Flahavan & Sons, Ltd., Kilnagrange Mills, Kilmacthomas.
Messrs. F. A. Waller & Co., Ltd., The Maltings, Banagher, Offaly.
Messrs. Enniscorthy Co-Op. Agricultural Society, Ltd., Enniscorthy.
Mr. Jas. O'Hara, Kenyon Street, Nenagh.
Mr. Garrett Byrne, Bree, Ballyhogue, Enniscorthy, Co. Wexford.
Mr. D. Daly, Earl Street, Mullingar.
Mr. Wm. Duggan, Carrick-on Suir, Co. Tipperary.
Messrs. W. & S. Armstrong, Ltd., Enniscorthy, Co. Wexford.
Mr. M. J. Corry, Sunmount, Glounthane, Co. Cork.
Mr. C. Meany, Rathroe House, Banteer, Millstreet.
Mr. J. D. O'Connor, Rathroe, Banteer, Millstreet, Co. Cork.
Mr. M. Coughlan, Ballyhirst, Carrick-on-Suir, Co. Tipperary.

The Albert Agricultural College co-operated with the Department in the working of the foregoing scheme and stocks were distributed as follows:—

ARDRI	*Brls.*	*Sts.*
E. J. Sheehy, Sillogue Farm, Gibbstown, Co. Meath ..	7	—
H. M. Fitzpatrick, Kendalstown Hill, Delgany, Co. Wicklow	3	—
The Cereal Station, Ballinacurra, Co. Cork	40	—
B. Reynolds, "Eden," Grange Road, Rathfarnham, Dublin	3	7
W. Drummond & Sons, Ltd., 58, Dawson St., Dublin ..	5	—
Rev. P. E. Larkin, St. Patrick's College, Monaghan ..	1	—
Patrick Doyle, Coolagarry, Curraghboy, Athlone	8	—
John McDonnell, Grange, Curraghboy, Athlone	8	—
Michael Egan, Liscarn, Curraghboy, Athlone	6	—
John J. Gatley, Castletown, Athlone	6	—
Patrick McDonnell, Whitepark, Curraghboy, Athlone ..	4	—
Joseph Donnelly, Rahara, Roscommon	8	—
John S. Leonard, Balloy, Stamullen, Co. Meath	2	—

POTATO (ARDEE).	*Brls.*	*Sts.*
Agricultural School, Athenry, Co. Galway.	2	13
R. Smyth & Sons, Ballindrait, Co. Donegal	6	0

GLASNEVIN SUCCESS.	*Brls.*	*Sts.*
W. C. Meagher, Laha, Templemore, Co. Tipperary ..	2	—
E. J. Sheehy, Sillogue Farm, Gibbstown, Co. Meath ..	3	—
W. Drummond & Sons, Ltd., 58, Dawson Street, Dublin ..	25	—

J. H. Bennett, Ltd., Ballinacurra, Co. Cork ..	..	10	—
Rev. P. E. Larkin, St. Patrick's College, Monaghan	..	1	—
M. Rowan & Co., Ltd., 51, Capel Street, Dublin ..	..	15	—
Thos. McKenzie & Sons, Ltd., 212, Pearse Street, Dublin	..	15	—
H. R. Scanlan, Dublin Street, Balbriggan, Co. Dublin	..	5	—
P. J. O'Reilly, "Greyfort," Coleville Road, Clonmel	..	—	8

VICTORY II.		*Brls.*	*Sts.*
The Cereal Station, Ballinacurra, Co. Cork	..	16	—

WHEAT.

In 1944 propagation plots of Red Marvel and April Red Bearded wheats were grown at the Cereal Station, Ballinacurra, Co. Cork and an extension plot of 7 acres of Red Marvel was grown under contract, and under the Department's supervision, by Mr. William Tait, Hermitage, Rostellan, Co. Cork.

Under the scheme for the distribution of pedigree seed of Spring wheats the produce of the 1943 extension plot of Red Marvel was distributed to the undermentioned in the Spring of 1944 on the condition that the produce of it would be used for further propagation in 1945 :—

Pedigree Seed Growers, Ltd., 151, Thomas Street, Dublin.
Irish Sugar Beet Growers' Association, Ltd., Carlow.
Messrs. Minch Norton & Co., Ltd., Athy.
Messr. J. J. Stafford & Sons, Ltd., Wexford.

FLAX.

At the Cereal Station, Ballinacurra, garden plots of the following varieties were grown : Redwing, Bison, Buda, Newlands, Argentine Linseed, Boley Golden and Danish Pedigree 21.

SWEDES.

At the Cereal Station, Ballinacurra, seed stocks were raised from selected roots.

Seed thus saved in 1943 was distributed to the following :—

Associated Seed Growers, Ltd., 16, Westmoreland Street, Dublin.
Seed Producers, Ltd., Dame Street, Dublin.
Messrs. John Cox & Co., Ltd., Dundalk.
The Superintendents of the Agricultural Schools at Athenry, Co. Galway, Ballyhaise, Co. Cavan, and Clonakilty, Co. Cork.

Table showing in a general way the nature of the yields obtained in each county.

County	Gooseberries	Strawberries	Raspberries	Loganberries	Red and White Currants	Black Currants	Apples	Pears	Plums	Damsons	Other Fruits
Carlow	Good	Very Good	Very Good	Good	Average	Good	Good	Average	Poor	Poor	Average
Cavan	Good	Good	Good	Very Good	Very Good	Very Good	Good	Average	Poor	Poor	Average
Clare	Good	Good	Good	Good	Good	Very Good	Good	Average	Poor	Below Average	Good
Cork	Very Good	Average	Good	Very Good	Very Good	Very Good	Very Good	Average	Below Average	Poor	Good
Donegal	Good	Good	Good	Very Good	Good	Very Good	Good	Below Average	Poor	Poor	Average
Dublin	Good	Good	Good	Good	Very Good	Good	Very Good	Average	Average	Poor	Average
Galway	Very Good	Good	Good	Good	Good	Very Good	Very Good	Below Average	Poor	Poor	Good
Kerry	Very Good	Average	Average	Very Good	Average	Very Good	Good	Poor	Poor	Poor	Average
Kildare	Good	Good	Average	Good	Good	Good	Good	Below Average	Below Average	Poor	Good
Kilkenny	Good	Average	Good	Good	Good	Good	Average	Average	Poor	Poor	Average
Laoighis	Good	Good	Good	Good	Good	Good	Below Average	Below Average	Poor	Average	Good
Leitrim	Good	Good	Good	Good	Average	Good	Average	Average	Poor	Poor	Average
Limerick	Very Good	Very Good	Good	Very Good	Good	Very Good	Good	Below Average	Very Poor	Poor	Good
Longford	Very Good	Very Good	Good	Good	Very Good	Very Good	Above Average	Average	Poor	Below Average	Good
Louth	Very Good	Very Good	Good	Good	Good	Good	Good	Below Average	Average	Below Average	Good
Mayo	Good	Good	Average	Good	Very Good	Very Good	Very Good	Average	Poor	Average	Good
Meath	Average	Good	Good	Good	Very Good	Good	Good	Average	Above Average	Below Average	Good
Monaghan	Good	Good	Good	Good	Very Good	Very Good	Good	Good	Poor	Poor	Good
Offaly	Very Good	Good	Good	Very Good	Very Good	Very Good	Good	Below Average	Poor	Poor	Good
Roscommon	Very Good	Good	Average	Good	Good	Very Good	Good	Average	Poor	Poor	Average
Sligo	Very Good	Good	Good	Very Good	Very Good	Very Good	Very Good	Average	Average	Below Average	Average
Tipperary (N.R.)	Very Good	Good	Good	Very Good	Very Good	Good	Good	Poor	Poor	Below Average	Good
Tipperary, (S.R.)	Good	Average	Good	Very Good	Good	Average	Very Good	Below Average	Poor	Below Average	Good
Waterford	Very Good	Very Good	Very Good	Very Good	Good	Very Good	Very Good	Poor	Poor	Below Average	Good
Westmeath	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Above Average	Average	Below Average	Average	Good
Wexford	Good	Bad	Bad	Average	Good	Average	Average	Below Average	Very Poor	Poor	Good
Wicklow	Good	Good	Average	Average	Very Good	Very Good	Good	Poor	Very Poor	Poor	Good

FRUIT CROP REPORT, 1944.

From the fruit grower's point of view the weather experienced in 1944 was notable for two outstanding characteristics, an exceptionally dry spring followed by a cool wet summer and autumn.

Little rain fell in the early months of the year and dry weather continued up to the end of June. During July showery weather prevailed, and later a rainy spell set in which continued during August and September, the latter month being particularly wet—the wettest recorded in the Dublin district for over seventy years with the exception of 1930.

The remaining months of the year were wet and little winter spraying was possible during December.

The reports indicated that spring frosts were not unduly severe, and that the amount of damage caused was not serious except in the case of plums, damsons, and pears which blossomed early.

The plum crop was in many areas considered to be the poorest for many years, and the yields from Damsons were reported to be from 60 per cent. to 70 per cent. of normal. Harsh weather at blossoming time was mainly responsible for the reduced yields in each case.

Other fruits, including apples, were reported to have escaped frost damage reasonably well and on the whole the small fruits gave better returns than had been expected during the prolonged drought. The yield of the strawberry crop was stated to have been below normal in the drier soils due to this cause.

Heavy gales during the first week of September caused a considerable fall of apples from the trees. Many of these were not required for manufacturing purposes and as a result they reached the fresh fruit market, rendering the trade slow for a period.

Reports did not indicate any abnormal outbreaks of insect pests. Apple Sawfly caused damage in some areas. Of fungoid diseases Apple Scab and American Gooseberry Mildew received most comment. The former was not found to have reached serious proportions early in the season, but developed rapidly with the onset of wet conditions later in the year. It was found that even in the case of orchards which had been thoroughly sprayed early in the season the disease developed quickly under the wetter conditions and proved difficult to control.

American Gooseberry Mildew was reported to be troublesome in many areas and required more than normal spraying to control it.

MARKET PRICES.

Apples.

Dessert Varieties :	Early ..	..	15/– to 30/– per bushel box.
	Mid-Season	..	18/– to 28/– ,, ,,
	Late ..	..	15/– to 40/– ,, ,,
Culinary Varieties :	..	..	9/– to 18/– ,, ,,
			10/– to 30/– per five-stone box.

Supplies of Bramley Seedling apples from the 1943 crop held in refrigerated gas stores were marketed in Dublin during May and June of this year at prices ranging from 55/– to 80/– per bushel.

Apples for Manufacturing Purposes : Jam fruit £5 to £8 per ton.
Cider Fruit £5 to £9 ,,

Strawberries.

In punnets from 1/2d. to 2/6d. per punnet and up to 4/6d. per punnet for earliest supplies at the beginning of June.

Jam Fruit :—70/– to 74/8d. per cwt.

Gooseberries.

7/– to 10/6d. per chip of about 12 lbs.
Jam Fruit 46/8d. per cwt.

Raspberries.

10d. to 1/8d. per lb.
Jam Fruit 60/– per cwt.

Black Currants.

8d. to 1/2d. per lb.
Jam Fruit 79/4d. per cwt.

Plums and Damsons.

Plums ..	..	12/– to 35/– per chip of about 12 lb.
Damsons	..	7/– to 12/– ,, ,, ,,

Damsons for Jam manufacture 54/– per cwt.

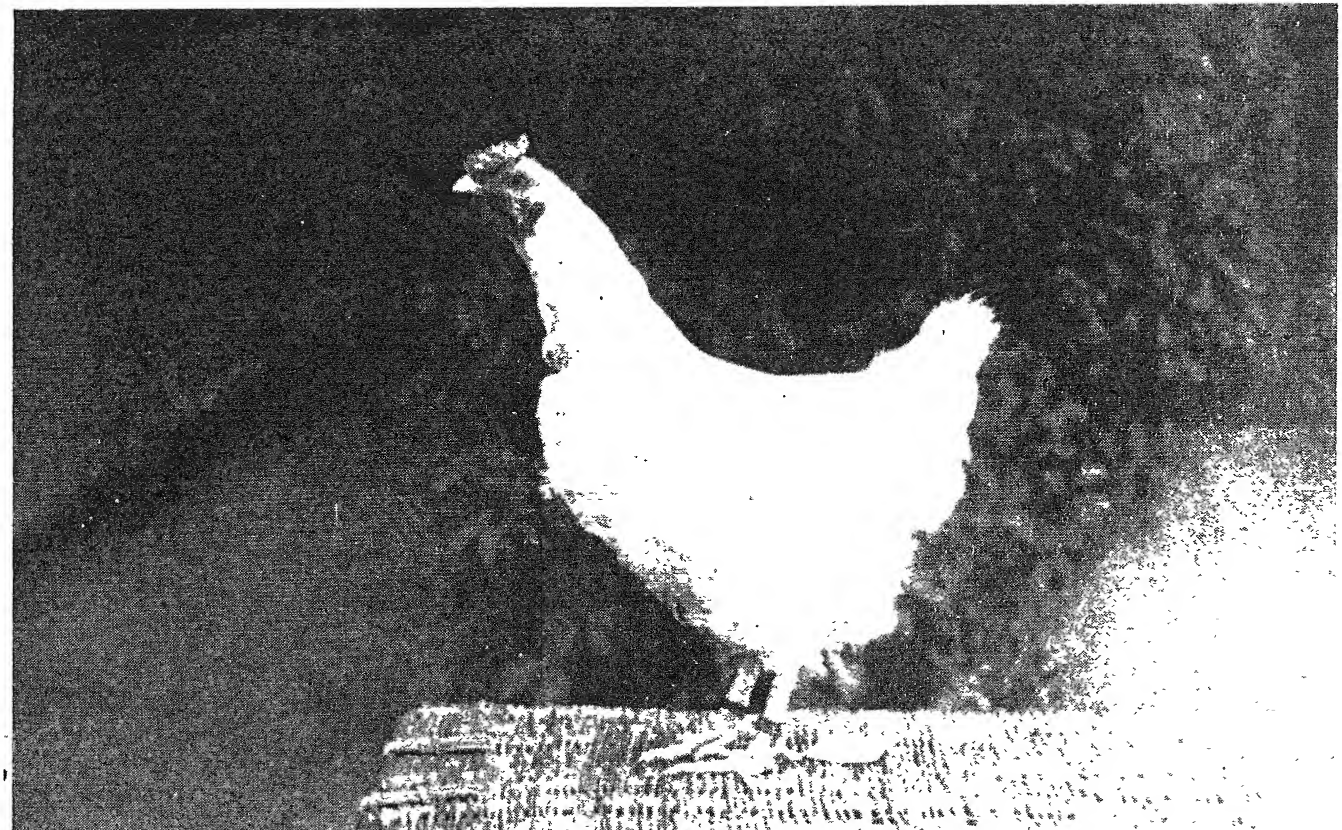
Blackberries.

28/– to 32/– per cwt.

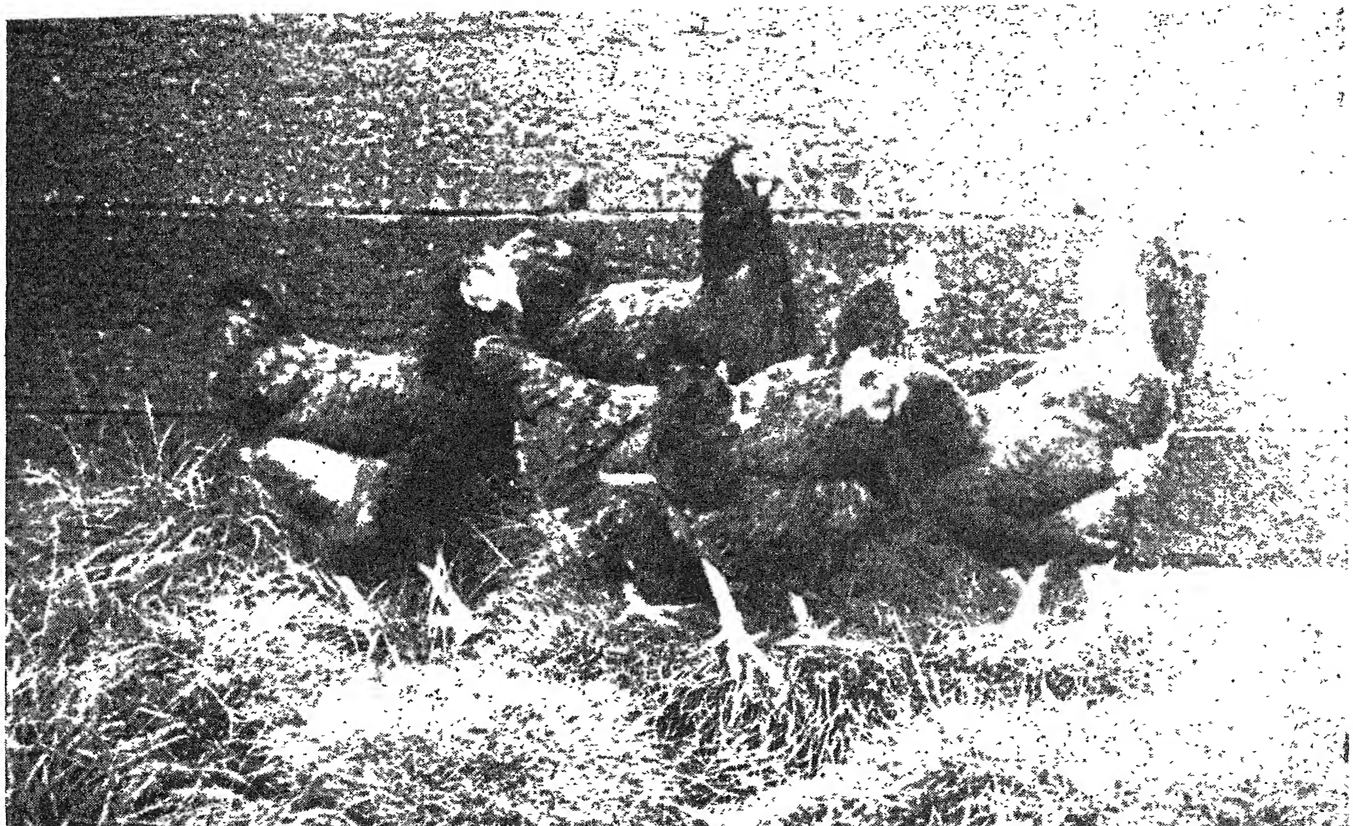
Bilberries.

48/– per cwt.

NATIONAL EGG-LAYING TEST, 1943-1944



Bird No. 140 (Pen No. 24, White Wyandotte), owned by Mrs. K. Ryan, Farnane, Lisnagry, Co. Limerick, awarded the Special Prize for the bird (sitting breed) scoring the highest number of points during the Test.



Pen No. 58 (Rhode Island Red), owned by Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford, which won the Silver Cup.

NATIONAL EGG-LAYING TEST, 1943-44.

The Thirty-second Egg-Laying Test, conducted by the Department of Agriculture, was held at the Munster Institute, Cork, during a period of 46 weeks, beginning on 1st October, 1943, and ending on 17th August, 1944. A total of 91 pens, each consisting of six pullets, having fulfilled the required conditions, was accepted and arranged in Sections as follows :—

Section I.—White Wyandotte	12 pens
Section II.—White Wyandotte (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1943)	16 „
Section III.—Rhode Island Red	15 „
Section IV.—Rhode Island Red (confined to holders of Egg Distribution (hen or hen and duck) Stations in 1943)	20 „
Section V.—Any non-sitting breed	10 „
Section VI.—Any other utility breed	18 „

Station holders were, as heretofore, allowed to enter a second pen in one of the open sections on payment of the requisite entry fee.

Only pullets which were certified by the Veterinary College, Ballsbridge, Dublin, as being non-reactors to the agglutination test for bacillary white diarrhoea were accepted.

Minimum Weights. The following were the prescribed minimum weights for the respective breeds :—

All non-sitting breeds ..	3 lb.
White Wyandotte	4½ lb.
Rhode Island Red	4½ lb.
Plymouth Rocks	5 lb.
Sussex	5 lb.
Any other sitting breed ..	5 lb.

Eggs were graded as follows :—

Egg Grades

Special Grade.—$2\frac{1}{8}$ ozs. and over for the first eight weeks (1st October to 25th November, inclusive), $2\frac{1}{4}$ozs. and over throughout the remainder of the test.

First Grade.—A minimum of $1\frac{15}{16}$ ozs. for the first eight weeks (1st October to 25th November, inclusive), and a minimum of 2 ozs. during the remainder of the test.

Eggs which weighed less than the weight prescribed for first grade were recorded but were not counted for scoring purposes.

System of Scoring

The system of scoring for the award of prizes was as follows :—

(*a*) Only special and first-grade eggs were counted for scoring purposes.

(*b*) The scoring for each egg of these grades was similar and as follows :—

Three (3) points for the first 12 weeks (1st Oct. to 23rd Dec.).

Two (2) points for the next 24 weeks (24th Dec. to 9th June).

Three (3) points for the remaining 10 weeks (10th June to 17th August).

(*c*) Points were not awarded for eggs defective in colour, shape or shell texture, but all such eggs were included in the records of production.

Egg Yields.

Making no allowance for deaths, the average number of eggs per bird was 168.3. The average number of eggs per bird for which a record for the full 46-week period was available was 183.3 (see Table II). The corresponding figures in the previous test were 172.9 and 180.4 respectively. The average production per bird during each of the twelve periods for each breed is given in Table III. One White Wyandotte which completed the test did not lay.

Egg Size.

Nine pens produced more than 20 per cent. of eggs under first grade.

Egg Weights.

The average weight of egg for each of the competing breeds is shown in Table IV. The average weight per dozen eggs for all breeds was 26.5 oz., as compared with 25.9 oz. for the previous test. In Table V are given the number and percentage of the

different grades of eggs for each breed in respect of birds which completed the full 46-week period.

Copper Rings. Of the 478 birds which completed the full 46-week period, 156 or 32.6 per cent. laid 200 or more special and first-grade eggs and not more than 20 per cent. under first grade. Of these, 127 were leg-banded with numbered sealed copper rings. Copper rings were withheld from the following 29 birds which were not suitable for breeding purposes :—

(*a*) Breed Standard Defects :—
- 7 White Wyandotte.
- 13 Rhode Island Red.
- 2 Light Sussex

(*b*) Consistent Producers of Defective Eggs :—
- 1 White Wyandotte.
- 5 Rhode Island Red.

(*c*) Constitutional Defects :—
- 1 White Wyandotte.

A total of 119 birds, representing 24.9 per cent. of the number surviving the full period of the test, laid over 160 but less than 200 special and first-grade eggs. Birds which laid more than 20 per cent. of eggs under first grade are not included in the foregoing total (see Table VII).

Mortality. During the period of the test 68 birds died, representing a mortality of 12.5 per cent., and an increase of 4.5 per cent. as compared with the previous test. The deaths were confined to a relatively small proportion of the pens, those occurring in 18 being responsible for over 66 per cent. of the total. The distribution of the total deaths amongst pens was as follows :—

9 pens	3 deaths each.
9 pens	2 ,, ,,
23 pens	1 death ,,

In the remaining 50 pens all birds completed the test. Analysis of the causes of death shows that, as in previous tests, peritonitis and oviductitis were responsible for the greatest proportion of the mortality. The incidence of gout and nephritis was high in the early periods of the test and these diseases were responsible for almost 24 per cent. of the total mortality.

B.W.D. Test. At the conclusion of the test the birds were submitted to the agglutination test for bacillary white diarrhœa, and there were no reactors.

Feeding. The rations fed consisted solely of home-produced foods. The system of feeding was similar to that in previous tests. The birds were fed three times daily. The morning feed consisted of half the grain ration given as scratch feed in the litter; the mid-day feed of wet mash, and the evening feed of the remainder of the grain ration fed in troughs. Dry mash was fed *ad lib.* and was made up to the following formula :—

4 parts by weight Barley Meal.
2 ,, ,, ,, Rolled Oats.
2 ,, ,, ,, Crushed Oats.
1 part ,, ,, Fishmeal.
½ ,, ,, ,, Grassmeal.

(During the latter part of the test, 2 parts barley were replaced by 2 parts pollard in the above formula).

The wet mash consisted of equal parts by weight of the dry mash and boiled potatoes. The morning grain feed was oats and the evening feed was made up of two parts oats and one part barley. Cabbage, kale, turnips and mangels were fed during winter and spring. Limestone grit was allowed *ad lib.*

The following quantities of foods were consumed :—

Mixed Meals	45,628 lb.
Potatoes	16.680 lb.
Grain	22,456 lb.
Limestone Grit	1,792 lb.

NOTES ON COMPETING BREEDS.

WHITE-WYANDOTTE.

Sections I and II. The majority of the birds in the 28 pens were of good quality. A few pens of birds and individual birds in other pens were backward on arrival and took some time to come into full production. The egg production of the birds surviving the test period was very satisfactory, while egg size and quality were excellent. Mortality was much higher than amongst this breed in the previous test.

RHODE ISLAND RED.

Sections III and IV. With few exceptions the birds included in the 35 pens were good specimens of the breed, of good colour and well developed. Production was satisfactory and egg size was exceptionally good, but some individual birds produced eggs defective in colour and texture. Mortality was much higher than in previous tests.

The winning pen, No. 58, (in Section III) owned by Miss M. O'Donovan Dromore, Villierstown, Cappoquin, also won the silver cup. The six birds were of high quality and laid 1,347 special and first-grade scoring eggs.

ANY NON-SITTING BREED.

Section V. The 10 pens of White Leghorns included many well-developed birds of high quality. Individual birds in a few pens were backward on arrival. Egg production was up to the standards in previous tests while egg size and quality were satisfactory. Mortality in this section was low.

ANY OTHER UTILITY BREED.

Section VI. This section comprised 17 pens of Light Sussex and 1 pen of Buff Plymouth Rocks. Some good pens of Light Sussex were entered but the birds generally were not of high quality. Production did not reach a high level but egg size and quality were satisfactory. Mortality in the breed was low. The pen of Buff Plymouth Rocks was of medium quality. Production was satisfactory while egg size and quality were very good.

CONCLUSION.

The results of the test were generally satisfactory. Egg production was well up to average, while egg size reached a higher level than in previous tests. Mortality was relatively high but many of the deaths were due to non-infectious causes. While the quality of the birds was generally satisfactory many birds under-developed or showing breed defects were sent to the test. Breeders would be well advised to devote more attention to the selection of their entries.

TABLE I.

The following Table shows the egg production for each of the thirty-two tests held since 1912-13 :—

Test Period	No. of Birds	No. of Eggs Laid	Average Number per Bird
Forty-eight weeks ended :—			
31st Aug., 1913	318	38,199	120.1
" 1914	282	39,216	139.0
" 1915	264	39,764	150.6
" 1916	294	49,830	169.5
" 1917	210	36,660	174.6
" 1918	210	36,106	171.9
" 1919	306	55,124	180.0
" 1920	354	65,840	186.0
" 1921	288	51,584	179.0
9th Sept., 1922	342	63,518	185.7
16th " 1923	198	38,519	194.5
15th " 1924	342	61,144	178.8
15th " 1925	348	63,755	183.2
15th " 1926	342	65,137	190.4
16th " 1927	492	93,912	190.9
16th " 1928	510	95,226	186.7
16th " 1929	540	101,820	188.6
16th " 1930	588	100,752	171.3
16th " 1931	588	111,180	189.1
15th " 1932	600	111,986	186.6
12th " 1933	606	113,047	186.5
10th " 1934	606	112,177	185.1
7th " 1935	702	131,384	187.1
3rd " 1936	702	130,940	186.5
Forty-six weeks ended :—			
18th Aug., 1937	708	125,621	177.4
18th " 1938	678	126,143	186.1
18th " 1939	708	133,306	188.3
17th " 1940	672	121,250	180.4
18th " 1941	642	114,617	178.5
18th " 1942	438	77,640	177.3
18th " 1943	510	88,167	172.9
17th " 1944	546	91,903	168.3

It should be noted that the figures given in Table I above are based on the total number of birds competing, no allowance having been made in respect of deaths.

Taking the birds which died during the 1943-44 test into account only up to the date of death, the average number of birds for the whole period was 518.3 and the average number of eggs per bird 179.0.

Table II.

Average Egg Yield for each Breed.

Breed	Number of Birds for full period	Number of Eggs Laid	Average Number of Eggs per Bird	Grade Averages per Bird		
				Special	First	Under First
White Wyandotte ..	147	27,392	186.3	107.7	69.6	9.0
Rhode Island Red ..	177	33,906	191.6	98.0	78.9	14.7
White Leghorn ..	55	9,976	181.4	89.3	72.2	19.9
Light Sussex	94	15,446	164.3	58.9	89.1	16.3
Buff Rock	5	874	174.8	131.2	41.4	2.2
All Breeds	478	87,594	183.3	92.6	76.9	13.8

Table III.

Average Egg Yield per Bird during each of the Twelve Periods.

Breed	Number of Birds for full period	Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Average for full period
White Wyandotte	147	10.6	13.0	17.1	17.4	17.8	18.7	19.6	18.5	16.7	15.1	15.2	6.6	186.3
Rhode Island Red	177	10.5	9.9	15.6	17.8	18.1	19.8	21.7	21.0	18.2	16.8	15.5	6.7	191.6
White Leghorn ...	55	8.2	12.2	14.6	16.7	17.9	19.4	20.5	19.9	17.4	15.0	13.8	5.8	181.4
Light Sussex ...	94	8.8	7.3	12.9	16.6	17.8	18.3	18.8	17.4	13.8	13.4	13.3	5.9	164.3
Buff Rock ...	5	9.6	10.2	15.4	14.0	18.6	19.4	20.8	17.2	15.0	13.6	12.6	8.4	174.8
All Breeds ...	478	9.9	10.6	15.4	17.3	17.9	19.2	20.4	19.3	16.8	15.4	14.7	6.4	183.3

TABLE IV.

Average Weight of Egg for each Breed.

BREED	Total Number of Eggs Laid	Total Weight of Eggs	Average Weight of Egg	Average Weight per Dozen
		lb. oz. dr.	*oz. dr.*	*oz.*
White Wyandotte ..	28,924	4,024 2 15	2 4	26.7
Rhode Island Red ..	35,882	4,974 1 4	2 3	26.6
White Leghorn ..	10,275	1,413 14 6	2 3	26.4
Light Sussex	15,877	2,137 2 5	2 2	25.8
Buff Rock	945	137 11 12	2 5	28.0
All Breeds ..	91,903	12,687 0 10	2 3	26.5

TABLE V.

Number and Percentage of Special, First and under First Grade Eggs for each Breed in respect of Birds which completed the full 46-week Period.

BREED	EGGS LAID			PERCENTAGE DISTRIBUTION		
	Special Grade	First Grade	Under First Grade	Special Grade	First Grade	Under First Grade
				%	%	%
White Wyandotte ..	15,832	10,230	1,330	57.8	37.3	4.9
Rhode Island Red ..	17,333	13,967	2,606	51.1	41.2	7.7
White Leghorn ..	4,912	3,970	1,094	49.2	39.8	11.0
Light Sussex	5,535	8,378	1,533	35.8	54.3	9.9
Buff Rock	656	207	11	75.0	23.7	1.3
All Breeds ..	44,268	36,752	6,574	50.5	42.0	7.5

Table VI.

Number and Percentage of Birds which laid 200 Special and First Grade Eggs or over, and not more than twenty per cent. under First Grade.

Breed	Number of Birds for full Period	Number of Birds which laid 200 Special and First Grade Eggs, or over	Percentage
			%
White Wyandotte	147	64	43.5
Rhode Island Red	177	69	39.0
White Leghorn	55	12	21.8
Light Sussex	94	11	11.7
Buff Rock	5	—	—
All Breeds	478	156	32.6

Table VII.

Number and Percentage of Birds which laid over 169 but less than 200 Special and First Grade Eggs and not more than 20 per cent. under First Grade. The figures are based on the number of birds which completed the Test.

Breed	Number of Birds	Percentage
		%
White Wyandotte	32	21.8
Rhode Island Red	44	24.9
White Leghorn	19	34.5
Light Sussex	20	21.3
Buff Rock	4	80.0
All Breeds	119	24.9

Table VIII.

Egg Records of Birds which were awarded Copper Rings.

White Wyandotte (55 Birds).

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
2	7 11	2512 2514	115 197	120 12	5 1	240 210	Mrs. M. Stanton, Woodlands, Glanmire, Co. Cork.
3	17 18	2515 2516	108 188	106 19	4 1	218 208	Mrs. M. J. Smith, Colmanstown, Ballinasloe, Co. Galway.
4	19 20 21 22 23	2517 2518 2519 2520 2521	157 238 140 204 160	104 19 78 9 92	— — 3 1 3	261 257 221 214 255	Mrs. M. J. Smith, Colmanstown, Ballinasloe, Co. Galway.
5	25 28 30	2522 2523 2524	206 187 127	5 23 89	— 3 20	211 213 236	Mr. V. E. H. Bewley, Danum Firs, Zion Road, Rathgar, Dublin.
8	43 44	2525 2526	71 220	188 4	4 —	263 224	Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.
9	49 50 52	2527 2528 2529	184 192 57	16 18 156	— — 14	200 210 227	Sister-in-Charge, St. Martha's College, An Uaimh, Co. Meath.
10	55	2530	15	197	9	221	Miss B. Quain, Anglesboro', Co. Limerick, *via* Mitchelstown.
11	63	2531	72	160	7	239	Mrs. M. Nagle, Springmount, Mallow, Co. Cork.
12	71	2532	165	48	7	220	Mr. W. Barron, "Woodview," Gortrush, Piltown, Co. Kilkenny.
13	1 3	2533 2534	156 166	46 53	— 5	202 224	Mrs. M. Stanton, Woodlands, Glanmire, Co. Cork.

Pen Number	Bird Number	Number of Scaled Copper Ring	Eggs Laid — Special Grade	Eggs Laid — First Grade	Eggs Laid — Under First Grade	Eggs Laid — Total	Name and Address of Owner
14	79 82	2535 2536	45 41	171 160	7 12	223 213	Mrs. B. Coughlan, Ruane, Eyrecourt, Ballinasloe, Co. Galway.
16	98 99	2537 2538	154 137	49 66	1 —	204 203	Mrs. M. Heverin, Cortoon, Brownsgrove, Tuam, Co. Galway.
17	103 106	2540 2541	158 181	67 26	3 2	228 209	Mrs. R. B. Eadie, The Poplars, Beaufort, Co. Kerry.
19	110 111 112 114	2542 2543 2544 2545	144 55 10 91	69 158 194 137	1 8 16 3	214 221 220 231	Mrs. M. O. Roberts, Lakemount, Glanmire, Co. Cork.
21	123	2547	231	10	—	241	Mrs. B. Martin, Corglass, Kingscourt, Co. Cavan.
22	129 131	2548 2549	215 70	29 136	— 6	244 212	Sister-in-Charge, Rural Domestic Economy School, Swinford, Co. Mayo.
24	139 140 141 143 144	2550 2551 2552 2553 2554	170 93 157 11 74	36 178 68 196 145	1 15 5 38 24	207 286 230 245 243	Mrs. K. Ryan, Farnane, Lisnagry, Co. Limerick.
26	152 153 154 155	2555 2556 2557 2558	113 97 207 90	95 119 12 127	3 4 1 25	211 220 220 242	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.
27	157 161	2559 2560	31 144	190 56	9 3	230 203	Mrs. J. Scally, Ballyteague, Ballycommon, Daingean, Offaly.
28	163	2561	187	14	—	201	Mr. W. Barron, "Woodview," Gortrush, Piltown, Co. Kilkenny.

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
29	260 262	2562 2563	169 196	39 44	1 —	209 240	Miss M. O'Keeffe, Ballybooden, Knocktopher, Co. Kilkenny.
31	176 178	2564 2565	177 182	28 59	— —	205 241	Mrs. E. M. J. Condron, Knocktemple, Virginia, Co. Cavan.
32	73 74 77 78	2566 2567 2568 2569	226 34 197 130	3 207 5 73	— 26 1 11	229 267 203 214	Mrs. M. Connolly, Carrigamore, Corvalley P.O., Co. Monaghan.

Rhode Island Red (51 Birds).

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
49	212 215	2570 2571	154 37	76 213	1 7	231 257	Mrs. K. Sammon, Carrigahorig, Lorrha, Birr, Offaly.
50	217 221 222	2572 2573 2574	132 69 2	99 156 205	2 12 18	233 237 225	Mrs. N. O'Sullivan, Hill View, Clogheen, Clonakilty, Co. Cork.
52	230 232	2575 2576	37 79	177 149	4 10	218 238	Mrs. K. Cuddihy, Hillside Poultry Farm, Glenmore, Co. Kilkenny.
53	237 239	2577 2578	118 99	87 122	2 8	207 229	Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.
55	194 197	2579 2580	78 104	147 105	3 1	228 210	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.
56	255	2581	184	27	1	212	Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.
57	184	2582	171	53	1	225	Lady M. Athlumney, Somerville, Balrath, Co. Meath.

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
58	265 266 267 268 269	2583 2584 2585 2586 2587	27 84 182 222 82	197 144 53 4 166	30 4 2 — 3	254 232 237 226 251	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.
60	277 278	2588 2589	175 157	27 61	— 8	202 226	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.
63	295	2590	215	6	—	221	Mrs. D. Philpott, Charlesfield, Banteer, Co. Cork.
64	306	2591	14	203	8	225	Mrs. K. Sammon, Carrigahorig, Lorrha, Birr, Offaly.
65	308	2592	210	5	—	215	Mrs. E. Hammersley, Ashvale, Lattin, Tipperary.
66	315 316 318	2593 2594 2595	200 36 26	26 169 177	1 5 11	227 210 214	Mrs. J. McCarthy, Caherelly Castle, Grange, Kilmallock, Co. Limerick.
67	323	2596	172	50	2	224	Mrs. E. O'Donnell, Kilbreedy West, Kilmallock, Co. Limerick.
68	326 328 329 330	2597 2598 2599 2600	97 171 19 217	144 73 206 13	8 2 26 1	249 246 251 231	Mrs. B. McAuliffe, Farrihy, Broadford, Charleville, (Co. Limerick).
70	331 332 333 335	2601 2602 2603 2604	7 113 83 223	204 87 138 6	26 5 14 —	237 205 235 229	E. Bean Mhic Dhomhnaill, Imeall Atha, Baile an Fheirt[illegible]igh, Co. Chiarraidhe,
71	375 376	2605 2606	168 167	37 64	2 2	207 233	Mr. W. Murphy. Skeeter Park, Cleariestown, Co. Wexford.
74	357 360	2607 2608	66 172	166 44	3 —	235 216	Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.
75	361 363	2609 2610	194 158	45 68	1 —	240 226	Mrs. N. Smyth, Kilcloon, Dunboyne, Co. Meath.

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
78	379 384	2611 2612	194 177	17 48	— 1	211 226	Mrs. L. Hayes, Walshestown, Castlemahon, Newcastle West, Co. Limerick.
80	387 388 390	2613 2614 2615	207 197 104	3 5 119	1 — 4	211 202 227	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.
81	417	2616	76	130	2	208	Mrs. B. M. Raftet, Knockthomas, Nurney, Bagnalstown, Co. Carlow.
82	397 398	2617 2618	145 61	62 166	6 8	213 235	Miss M. Mulcahy, Abbey View, Clonmel, (Co. Waterford).
84	409 410	2619 2620	179 40	24 182	4 9	207 231	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.

White Leghorn (12 Birds).

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	Eggs Laid: First Grade	Eggs Laid: Under First Grade	Eggs Laid: Total	Name and Address of Owner
86	426	1819	186	41	2	229	Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.
87	436	1820	187	14	1	202	Mrs. P. Kelly, Mount Mary, Ballygar, Co. Galway.
88	440 443	1821 1822	39 115	161 114	15 4	215 233	Mrs. M. J. Smith, Colmanstown, Ballinasloe, Co. Galway.
92	467 468	1823 1824	204 94	7 108	— —	211 202	Sister-in-Charge, St. Martha's College, An Uaimh, Co. Meath.
93	471 472 473 474	1825 1826 1827 1828	120 17 166 178	114 189 75 22	1 48 1 1	235 254 242 201	Sister-in-Charge, Rural Domestic Economy School, Swinford, Co. Mayo.
100	428 430	1829 1830	149 62	67 153	6 4	222 219	Mrs. M. O'Shea, Farrantane, Castlegregory, Co. Kerry.

Light Sussex (9 Birds).

Pen Number	Bird Number	Number of Sealed Copper Ring	Eggs Laid: Special Grade	First Grade	Under First Grade	Total	Name and Address of Owner
102	582	2621	171	32	—	203	Miss M. Daly, Knockglass, Moynalty, Ceanannus Mor, Co. Meath.
104	497	2622	119	106	4	229	Mrs. N. O'Sullivan, Hill View, Clogheen, Clonakilty, Co. Cork.
107	511 514	2623 2624	104 42	121 173	4 21	229 236	Mrs. M. Keatley, Boakefield, Ballytore, Co. Kildare.
108	518	2625	137	72	1	210	Sister-in-Charge, St. Martha's College, An Uaimh, Co. Meath.
109	524 527	2626 2627	214 162	12 48	1 5	227 215	Mrs. M. Nagle, Springmount, Mallow, Co. Cork.
111	530	2628	64	143	9	216	Mrs. J. Hely-Hutchinson, Lissen Hall, Swords, Co. Dublin.
114	556	2629	55	146	8	209	Sister-in-Charge, St. Mary's Abbey, Glencairn, Co. Waterford.

Table IX.

Results of post-mortem examinations performed by the Veterinary College.

Date of Death	Number of Bird	Number of Pen	Breed	Result of Post-mortem Examination
1943				
Oct. 15	336	70	Rhode Island Red	Visceral gout.
,, 16	371	65	Rhode Island Red	Peritonitis and oviductitis.
,, 18	68	12	White Wyandotte	Gout.
,, 18	166	28	White Wyandotte	Nephritis.
,, 18	310	65	Rhode Island Red	Gout.
,, 18	448	89	White Leghorn	Gout.
,, 21	412	81	Rhode Island Red	Gout.
,, 25	362	75	Rhode Island Red	Visceral gout.
,, 26	531	110	Light Sussex	Visceral gout.
Nov. 1	364	75	Rhode Island Red	Nephritis.
,, 8	34	6	White Wyandotte	Nephritis.
,, 10	498	104	Light Sussex	Peritonitis and oviductitis
,, 15	378	71	Rhode Island Red	Lymphomatosis of the ovary.
25	24	4	White Wyandotte	Congestion of the lungs.
Dec. 2	61	11	White Wyandotte	Impaction of the crop.
,, 13	241	54	Rhode Island Red	Neuro-lymphomatosis
,, 17	200	47	Rhode Island Red	Enteritis
,, 21	94	15	White Wyandotte	Neuro-lymphomatosis.
,, 21	286	61	Rhode Island Red	Iritis.
,, 28	300	63	Rhode Island Red	Visceral lymphomatosis.
1944				
Jan. 3	207	48	Rhode Island Red	Neuro-lymphomatosis
,, 6	61	11	White Wyandotte	Neuro-lymphomatosis.
,, 21	181	57	Rhode Island Red	Peritonitis.
,, 24	258	56	Rhode Island Red	Lymphomatosis of the bowel and ovary.
,, 26	451	90	White Leghorn	Acute inflammation of the egg passage.
,, 31	425	86	White Leghorn	Peritonitis.
Feb. 9	288	61	Rhode Island Red	Cancerous growth on eye.
,, 26	229	52	Rhode Island Red	Blood tumours of the liver and spleen.
,, 28	105	17	White Wyandotte	Peritonitis.
Mar. 1	65	11	White Wyandotte	Necrotic ulceration of the pharynx.
,, 9	257	56	Rhode Island Red	Peritonitis.
,, 24	309	65	Rhode Island Red	Peritonitis.
,, 24	404	83	Rhode Island Red	Lymphomatosis of the peritoneum.
April 3	109	19	White Wyandotte	Peritonitis.
,, 4	165	28	White Wyandotte	Tuberculosis.
,, 6	421	86	White Leghorn	Peritonitis.
,, 11	373	71	Rhode Island Red	Nephritis.
,, 15	407	83	Rhode Island Red	Neuro-lymphomatosis.
,, 21	526	109	Light Sussex	Visceral gout.
,, 24	374	71	Rhode Island Red	Lymphomatosis of the heart.
,, 27	366	75	Rhode Island Red	Tuberculosis.
,, 28	287	61	Rhode Island Red	Neuro-lymphomatosis.
,, 28	368	76	Rhode Island Red	Peritonitis.
,, 29	126	21	White Wyandotte	Rupture of a fatty liver.
May 5	525	109	Light Sussex	Tapeworm and capillaria worm infestation.
,, 9	465	92	White Leghorn	Tapeworm and roundworm infestation.
,, 17	81	14	White Wyandotte	Neuro-lymphomatosis.
,, 26	578	102	Light Sussex	Peritonitis and enteritis.
June 7	240	53	Rhode Island Red	Tuberculosis.
,, 10	554	114	Light Sussex	Visceral gout and peritonitis.
,, 19	253	56	Rhode Island Red	Pneumonia and capillaria worm infestation.
,, 20	108	17	White Wyandotte	Visceral gout.
,, 30	45	8	White Wyandotte	Peritonitis and oviductitis.

TABLE IX.—*continued.*

Date of Death	Number of Bird	Number of Pen	Breed	Result of Post-mortem Examination
June 30	236	53	Rhode Island Red	Tuberculosis.
July 3	213	49	Rhode Island Red	Peritonitis and oviductitis.
„ 3	182	57	Rhode Island Red	Visceral gout.
„ 10	485	118	Buff Rock	Lymphomatosis of the ovary and kidneys.
„ 15	91	15	White Wyandotte	Leukæmia and peritonitis.
„ 20	60	10	White Wyandotte	Oviductitis.
„ 21	552	113	Light Sussex	Peritonitis.
„ 21	297	63	Rhode Island Red	Peritonitis and oviductitis.
„ 22	30	6	White Wyandotte	Enteritis.
„ 22	406	83	Rhode Island Red	Peritonitis and oopheritis.
„ 25	369	76	Rhode Island Red	Oviductitis.
„ 25	32	6	White Wyandotte	Enteritis.
„ 25	96	15	White Wyandotte	Visceral gout.
Aug. 1	70	12	White Wyandotte	Ruptured fatty liver.
„ 14	593	101	Light Sussex	Peritonitis.

TABLE X.

Number and Percentage of Deaths for each Breed.

BREED	Number of Birds Penned	Number of Deaths	Percentage of Deaths
			%
White Wyandotte	168	21	12.5
Rhode Island Red	210	33	15.7
White Leghorn	60	5	8.3
Light Sussex	102	8	7.8
Buff Rock	6	1	16.7
All Breeds	546	68	12.5

SECTION PRIZES.

SECTION I—WHITE WYANDOTTE.

	OWNER OF PEN	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Mrs. M. Stanton, Woodlands, Glanmire, Co. Cork.	3,006	1,237
Second Prize (£7) :	Mrs. M. J. Smith, Colmanstown, Ballinasloe, Co. Galway.	2,938	1,204
Third Prize (£5) :	Sister-in-Charge, St. Martha's College, An Uaimh, Co. Meath.	2,787	1,158
Fourth Prize (£4) :	Sister-in-Charge, School of Domestic Science, Dunmanway, Co. Cork.	2,568	1,064
Fifth Prize (£2) :	Mrs. M. Stanton, Woodlands, Glanmire, Co. Cork.	2,516	1,039

Section II—White Wyandotte (Station Holders).

	Owner of Pen	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Mrs. K. Ryan, Farnane, Lisnagry, Co. Limerick.	3,126	1,307
Second Prize (£7) :	Mrs. K. F. Graham, Ballagh Lodge, Donadea, Co. Kildare.	2,805	1,189
Third Prize (£5) :	Mrs. M. Connolly, Carrigamore, Corvalley P.O., Co. Monaghan.	2,782	1,182
Fourth Prize (£4) :	Sister-in-Charge, Rural Domestic Economy School, Swinford, Co. Mayo.	2,761	1,153
Fifth Prize (£2) :	Mrs. M. Heverin, Cortoon, Brownsgrove, Tuam, Co. Galway.	2,731	1,146

Section III—Rhode Island Red.

	Owner of Pen	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	3,247	1,347
Second Prize (£7) :	Mrs. N. O'Sullivan, Hill View, Clogheen, Clonakilty, Co. Cork.	2,782	1,192
Third Prize (£5) :	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.	2,591	1,105
Fourth Prize (£4) :	Mrs. K. Earl, Grantstown House, Waterford.	2,531	1,072
Fifth Prize (£2) :	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.	2,475	1,058

Section IV—Rhode Island Red (Station Holders).

	Owner of Pen	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Miss M. Mulcahy, Abbey View, Clonmel, (Co. Waterford).	2.896	1,195
Second Prize (£7) :	Mrs. B. M. Rafter, Knockthomas, Nurney, Bagnalstown, Co. Carlow.	2,691	1,148
Third Prize (£5) :	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	2,659	1,098
Fourth Prize (£4) :	Mrs. L. Hayes, Walshestown, Castlemahon, Co. Limerick.	2,570	1,086
Fifth Prize (£2) :	Mrs. M. F. Smith, Bridge House, Bettystown, Co. Meath.	2,501	1,081

Section V—Any Non-Sitting Breed.

	Owner of Pen	Breed	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10) :	Sister-in-Charge, Rural Domestic Economy School, Swinford, Co. Mayo.	White Leghorn	2,768	1,137
Second Prize (£7) :	Mrs. M. O'Shea, Farrantane, Castlegregory, Co. Kerry.	do.	2,583	1,071
Third Prize (£5) :	Sister-in Charge, St. Martha's College, An Uaimh, Co. Meath.	do.	2,418	1,026
Fourth Prize (£4) :	Mrs. P. Kelly, Mount Mary, Ballygar, Co. Galway.	do.	2,391	1,011
Fifth Prize (£2) :	Mrs. M. J. Smith, Colmanstown, Ballinasloe, Co. Galway.	do.	2,378	986

Section VI—Any Other Utility Breed.

	Owner of Pen	Breed	Scoring Points	Special and First Grade Scoring Eggs
First Prize (£10):	Mrs. M. Comerford, Lamogue, Windgap, Co. Kilkenny.	Light Sussex	2,354	955
Second Prize (£7):	Sister-in-Charge, St. Martha's College, An Uaimh, Co. Meath.	do.	2,815	982
Third Prize (£5):	Mrs. M. Riordan, Glenleigh, Clogheen, Co. Tipperary.	do.	2,299	963
Fourth Prize (£4):	Mrs. A. Coleman, Ballycullen House, Croom, Co. Limerick.	Buff Rock	2,196	927
Fifth Prize (£2):	Miss B. Roche, Clearlestown, Co. Wexford.	Light Sussex	2,186	931

SPECIAL PRIZES.

The Special Prize of a Silver Cup (or its value, £10) for the *Pen* of birds scoring the highest number of points during the Test has been awarded to Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford, for Pen No. 58 (Rhode Island Red) which scored 3,247 points.

Special Prizes of £2 each have been awarded to the following owners :—

1. Mrs. K. Sammon, Carrigahorig, Lorrha, Birr, Offaly, for the sitting breed PEN No. 49 (Rhode Island Red) which scored 969 points during the period 1st October to 23rd December.

2. Sister-in-Charge, Rural Domestic Economy School, Swinford, Co. Mayo, for the non-sitting breed PEN No. 93 (White Leghorn) which scored 822 points during the period 1st October to 23rd December.

3. Sister-in-Charge, St. Martha's College, An Uaimh, Co. Meath, for the *individual* sitting breed bird No. 50 (Pen No. 9, White Wyandotte) which scored 201 points during the period 1st October to 23rd December.

4. Sister-in-Charge, Rural Domestic Economy School, Swinford, Co. Mayo, for the *individual* non-sitting breed bird No. 474 (Pen No. 93, White Leghorn) which scored 189 points during the period 1st October to 23rd December.

5. Mrs. K. Ryan, Farnane, Lisnagry, Co. Limerick, for the *individual* sitting-breed bird No. 140 (Pen No. 24, White Wyandotte) which scored 649 points during the Test.

6. Sister-in-Charge, Rural Domestic Economy School, Swinford, Co. Mayo, for the *individual* non-sitting breed bird No. 473 (Pen No. 93, White Leghorn) which scored 593 points during the Test.

SECTION I.—WHITE WYANDOTTE—12 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival lb.	Weight: On Arrival oz.	Weight: At Close of Test lb.	Weight: At Close of Test oz.	Eggs Laid: Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 16	Mar 17-Apl. 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug. 4-Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1-Dec. 28	Scoring Points per Bird: Full Period	Oct. 1-Dec. 28	Average Weight of Eggs per Bird oz.	dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
1	2	Mrs. M. Stanton,	March 10	7	5	0	7	10	11	25	25	21	22	22	23	20	19	24	19	9	115	120	5	240	—	56	578	168	2	3	—	(a) 1,250 Eggs
		Woodlands,	„	8	5	4	7	1	—	16	22	19	21	18	21	22	20	17	16	9	140	59	2	201	—	36	476	108	2	4	—	
		Glanmire,	„	9	5	7	7	5	—	24	20	22	17	20	19	23	19	17	16	7	157	47	—	204	1	44	489	132	2	5	—	(b) 27.3 oz.
		Co. Cork.	„	10	5	8	6	6	—	18	22	19	17	17	19	22	23	20	20	11	139	66	3	208	—	37	493	111	2	4	—	
			„	11	5	6	6	2	14	19	21	21	19	20	19	22	11	20	15	9	197	12	1	210	—	53	515	159	2	6	—	(c) 3,006 Points
			„	12	5	2	7	0	—	9	21	9	18	22	18	22	20	22	17	9	147	39	1	187	—	30	450	90	2	5	—	
2	4	Mrs. M. J. Smith,	Feb. 28	19	4	15	6	4	21	22	21	21	19	20	25	25	27	25	23	12	157	104	—	261	—	64	646	192	2	3	—	(a) 1,219 Eggs
		Colmanstown,	„	20	5	3	6	12	19	17	25	25	25	19	24	24	24	21	23	11	238	19	—	257	—	61	630	183	2	5	—	
		Ballinasloe,	„	21	5	2	6	7	20	2	20	21	19	21	20	23	21	21	23	10	140	78	3	221	—	39	529	117	2	4	—	(b) 27.2 oz.
		Co. Galway.	„	22	5	5	7	0	22	—	—	17	23	24	26	23	25	22	22	10	204	9	1	214	2	22	496	66	2	6	—	
			„	23	5	5	7	12	21	18	24	23	21	26	23	17	24	25	24	9	160	92	3	255	—	61	622	183	2	4	—	(c) 2,933 Points
			„	24	4	13	D		3	D8	—	—	—	—	—	—	—	—	—	—	—	5	6	11	—	5	15	15	1	15	—	
3	9	Sister-in-Charge,	Jan. 10	49	5	4	6	9	6	18	18	16	17	20	20	19	20	18	19	9	184	16	—	200	—	42	488	126	2	5	—	(a) 1,232 Eggs
		St. Martha's College,	„ 15	50	5	12	6	2	24	22	21	17	19	18	23	22	17	14	12	1	192	18	—	210	—	67	514	201	2	5	—	
		An Uaimh,	„	51	4	8	5	9	11	21	23	22	22	23	24	25	20	21	17	7	232	4	—	236	20	55	496	135	2	8	—	(b) 27.3 oz.
		Co. Meath.	„	52	5	4	5	6	5	21	24	22	23	25	20	21	22	19	15	7	57	156	14	227	21	50	456	150	2	2	—	
			„	53	5	2	6	9	17	—	—	11	23	21	20	17	14	18	22	3	80	79	7	166	2	15	370	45	2	3	—	(c) 2,737 Points
			Jan. 10	54	5	0	5	0	19	19	18	20	18	18	21	15	6	13	17	9	73	114	6	193	—	56	465	165	2	3	—	
4	7	Sister-in-Charge,	Feb. 2	37	5	3	6	2	2	—	25	22	20	22	23	23	10	19	9	10	32	144	9	185	—	22	410	66	2	1	—	(a) 1,123 Eggs
		School of Domestic	„	38	5	8	5	14	4	19	23	21	22	22	23	23	13	9	18	3	156	39	5	200	—	44	463	132	2	4	—	
		Science, St. Mary's,	March	39	5	8	6	9	18	20	20	20	20	19	20	23	17	16	15	5	35	147	31	213	—	45	457	135	2	1	—	(b) 26.7 oz.
		Dunmanway,	Feb. 2	40	5	4	6	6	21	20	21	20	18	21	18	17	16	16	15	7	155	50	5	210	—	58	505	174	2	4	—	
		Co. Cork.	„ 29	41	5	3	7	14	14	17	23	3	6	16	22	14	10	7	20	2	122	30	2	154	6	53	373	159	2	4	—	(c) 2,553 Points
			„ 2	42	5	0	6	0	14	12	20	17	19	16	15	21	17	8	2	—	156	4	1	161	—	46	375	138	2	7	—	
5	13	Mrs M. Stanton,	Feb. 20	1	6	6	7	1	20	19	20	20	20	20	20	19	21	10	10	3	156	46	—	202	—	59	456	177	2	4	—	(a) 1,055 Eggs
		Woodlands,	—	2	5	8	5	15	4	9	7	13	8	9	21	17	15	16	12	1	94	36	2	132	—	18	307	54	2	4	—	
		Glanmire,	—	3	5	10	6	6	10	20	21	18	21	20	22	22	22	19	20	9	166	53	5	224	—	46	582	138	2	4	—	(b) 27.4 oz.
		Co. Cork.	—	4	5	4	5	10	—	9	23	18	18	21	22	21	9	20	18	8	153	34	—	187	—	32	452	96	2	4	1	
			Feb. 20	5	6	0	7	14	—	5	24	9	—	12	21	17	18	13	17	8	140	4	—	144	1	29	353	87	2	6	—	(c) 2,516 Points
			—	6	6	0	5	13	19	9	12	12	18	15	17	16	14	14	10	8	118	40	—	164	6	40	386	120	2	5	—	

D = Dead

SECTION I.—WHITE WYANDOTTE—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight On Arrival lb. oz.	Weight At Close of Test lb. oz.	Eggs Laid Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 3–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
6	8	Mrs. M. O. Roberts,	Feb. 2	43	5 13	6 15	14	20	23	22	23	23	26	26	26	22	26	12	71	188	4	163	—	53	631	159	2 3	—	(a) 1,031 Eggs
		Lakemount,	Jan. 17	44	6 6	7 5	14	8	23	22	21	21	23	22	21	22	17	10	220	4	—	224	—	45	542	135	2 6	—	
		Glanmire,	"	45	5 13	D	9	—	—	—	—	—	—	—	—	D	—	—	7	2	—	9	—	9	27	27	2 2	—	(b) 26.9 oz.
		Co. Cork.	Feb. 2	46	5 14	6 14	16	20	18	16	19	21	21	14	10	17	15	4	122	68	1	191	—	53	469	159	2 3	—	
			"	47	6 6	7 7	9	14	16	19	13	17	16	18	13	11	10	5	46	111	4	161	3	35	307	105	2 2	—	(c) 2,465 Points
			"	48	6 10	7 5	3	2	19	20	18	12	20	22	19	20	18	10	140	40	3	183	—	22	429	66	2 4	—	
7	3	Mrs. M. J. Smith,	March 14	13	5 0	6 4	14	3	24	21	21	23	21	20	9	18	17	3	172	21	1	194	—	40	461	120	2 5	1	(a) 1,191 Eggs
		Colmanstown,	"	14	4 14	6 0	—	8	19	21	20	22	21	21	20	21	17	9	76	122	1	199	—	27	470	81	2 3	—	
		Ballinasloe,	"	15	5 3	6 10	18	19	17	15	11	13	18	13	9	11	5	5	154	—	—	154	2	54	379	162	2 8	—	(b) 26.7 oz.
		Co. Galway.	"	16	4 10	6 0	17	24	21	20	22	20	20	24	14	17	19	—	1	63	154	218	—	3	148	9	1 14	—	
			"	17	5 4	6 8	15	20	19	18	18	20	22	22	19	16	22	7	108	106	4	218	—	50	523	150	2 3	—	(c) 2,462 Points
			"	18	4 10	6 15	12	20	23	20	23	21	20	20	21	16	9	3	188	19	1	208	6	54	478	162	2 6	—	
8	10	Miss B. Quain,	March 25	55	4 12	7 2	—	8	23	25	21	22	25	21	23	21	22	7	15	197	9	221	—	26	500	78	2 2	—	(a) 1,013 Eggs
		Anglesboro',	"	56	5 2	9 6	—	6	14	9	5	—	7	5	—	2	—	—	31	17	—	48	—	20	118	60	2 6	—	
		Co. Limerick,	"	57	4 14	7 5	—	11	21	20	22	19	21	19	23	21	20	10	164	41	2	207	—	30	491	90	2 4	—	(b) 26 4 oz.
		via Mitchelstown.	"	58	4 10	7 5	—	—	13	15	21	24	21	23	24	23	22	11	57	137	3	197	1	11	451	33	2 3	—	
			"	59	4 9	6 14	—	—	15	20	17	22	21	19	19	12	14	11	116	53	1	170	1	14	387	42	2 4	1	(c) 2,308 Points
			"	60	4 8	D	—	—	19	20	20	21	21	25	21	15	D	—	37	125	8	170	—	14	361	42	2 2	—	
9	12	Mr. W. Barron,	March 2	67	5 0	5 15	6	18	20	16	17	15	19	19	15	14	10	6	79	88	8	175	—	37	401	111	2 3	—	(a) 1,005 Eggs
		"Woodview,"	"	68	4 14	D	*d*10	—	—	—	—	—	—	—	—	—	—	—	—	1	9	10	—	1	3	3	1 12	—	
		Gortrush,	"	69	4 15	7 5	9	12	15	16	17	15	20	21	16	18	18	8	68	111	6	185	—	31	433	93	2 3	—	(b) 26 4 oz.
		Piltown,	"	70	5 2	D	8	21	21	19	17	21	22	22	21	17	*d*17	—	180	22	4	206	—	46	484	138	2 5	—	
		Co. Kilkenny.	"	71	5 7	5 14	16	19	13	15	22	22	25	25	21	20	15	7	165	48	7	220	3	41	501	123	2 4	—	(c) 2,273 Points
			"	72	5 2	6 14	—	24	21	19	22	23	23	21	19	14	14	9	30	165	14	209	6	37	451	111	2 2	—	
10	5	Mr. V. E. H. Bewley,	Jan. 22	25	6 10	7 9	—	15	16	20	18	22	22	22	20	22	23	11	206	5	—	211	2	31	503	93	2 6	—	(a) 965 Eggs
		Danum Firs,	Mar. 4	26	6 2	6 14	14	19	11	2	3	—	—	—	4	3	—	—	48	7	1	56	3	43	149	120	2 4	—	
		Zion Road,	Mar. 16	27	5 12	7 2	21	16	11	15	14	15	17	19	19	14	16	10	133	50	7	190	—	44	450	132	2 4	—	(b) 27.5 oz.
		Rathgar,	" 16	28	5 8	6 6	18	18	20	19	21	17	20	18	19	18	17	8	187	23	3	213	2	53	511	159	2 5	—	
		Dublin.	Feb. 2	29	5 5	7 2	—	—	—	16	24	10	—	—	—	—	—	—	40	18	1	59	—	—	116	—	2 4	—	(c) 2,250 Points
			" 2	30	5 0	5 8	20	18	17	19	22	22	22	20	22	21	22	11	127	89	20	236	—	36	521	108	2 3	—	

D=Dead

SECTION I.—WHITE WYANDOTTE—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival (lb. oz)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec 23	Scoring Points per Bird: Full Period	Oct 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
11	11	Mrs. M. Nagle,	Feb. 6	61	5 14	D	18	—	—	D	—	—	—	—	—	—	—	—	4	12	2	18	—	16	48	18	2 0	—	(a) 707 Eggs
		Springmount,	”	62	6 14	7 11	13	8	18	19	18	21	21	20	20	15	13	5	190	1	—	191	1	39	451	114	2 9	—	
		Mallow,	”	63	6 0	7 14	17	15	22	22	17	20	25	24	23	26	21	7	72	160	7	239	—	49	567	147	2 2	—	(b) 27.7 oz.
		Co. Cork.	Mar. 16	64	5 10	D	10	2	D	—	—	—	—	—	—	—	—	—	—	2	10	12	—	2	6	6	1 13	—	
			Feb. 6	65	6 0	D	8	10	17	8	—	D	—	—	—	—	—	—	20	18	5	45	—	30	106	90	2 2	—	(c) 1,671 Points
			”	66	4 14	5 14	16	18	21	22	17	20	17	17	21	17	12	6	189	14	1	204	1	54	493	162	2 6	—	
*	6	Mrs. M. F. Bailey,	Jan. 30	31	4 15	5 14	12	19	21	18	22	20	22	21	20	7	12	—	24	157	13	194	—	45	422	135	2 2	—	(a) 735 Eggs
		Shanavaughy House,	”	32	4 8	D	11	21	19	20	13	7	12	9	—	—	D	—	56	52	4	112	—	48	264	144	2 3	—	
		Ballacolla,	”	33	4 12	5 10	20	1	—	4	23	24	14	16	6	10	13	10	10	110	21	141	—	13	282	39	2 1	3	(b) 25.0 oz.
		Laoighis,	”	34	5 4	D	19	D 2	—	—	—	—	—	—	—	—	—	—	—	14	7	21	—	14	42	42	1 15	—	
			”	35	5 6	6 8	20	17	20	19	15	15	10	—	—	4	4	1	106	19	—	125	2	57	310	171	2 4	—	(c) 1,400 Points
			Feb. 18	36	4 9	D	21	23	21	25	22	21	5	4	—	—	D	—	—	35	107	142	—	10	80	30	1 14	—	

*Pen produced more than 20 per cent. of eggs under first grade. D = Dead

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—16 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
1	24	Mrs. K. Ryan,	Jan. 24	139	4 15	5 11	4	12	19	19	21	16	19	22	21	21	13	12	170	36	1	207	2	35	491	105	2 5	—	(a) 1,144 Eggs
		Farnane,	"	140	5 12	6 12	18	22	15	28	28	27	27	27	27	27	27	15	93	178	15	286	—	44	649	182	2 2	—	(b) 25.7 oz.
		Lisnagry,	"	141	5 6	6 8	23	22	20	23	25	22	18	19	20	17	19	6	157	68	5	250	—	61	564	193	2 4	—	(c) 3,136 Points
		Co. Limerick.	"	142	5 3	5 6	19	22	24	19	22	21	23	21	15	20	22	5	7	174	52	233	—	26	427	73	2 0	—	
			"	143	5 8	6 10	14	25	23	24	21	25	21	24	26	17	20	10	11	196	38	245	—	35	495	105	2 1	—	
			"	144	5 8	6 6	14	26	23	26	22	21	22	23	22	23	5	12	74	145	24	243	—	59	517	117	2 2	—	
2	26	Mrs. K. F. Graham,	Jan. 20	151	6 0	6 6	18	2	—	—	—	6	15	7	13	15	12	8	49	43	4	96	—	19	237	57	2 3	—	(a) 1,181 Eggs
		Ballagh Lodge,	Feb. 11	152	5 4	6 6	13	17	21	19	15	19	21	19	19	21	19	8	113	95	3	211	1	49	511	147	2 3	—	(b) 26.6 oz.
		Donadea,	"	153	4 12	5 12	17	20	20	18	18	21	21	20	16	17	21	11	97	119	4	220	—	53	534	159	2 3	—	(c) 2,805 Points
		Co. Kildare.	"	154	5 0	6 10	16	6	25	18	19	21	21	21	24	22	19	10	207	12	1	220	1	44	530	129	2 5	—	
			"	155	4 12	5 12	20	23	19	19	22	21	21	25	20	22	22	9	90	127	25	212	1	37	528	111	2 2	—	
			"	156	5 0	7 0	21	17	19	21	21	14	10	11	18	9	14	11	110	80	2	192	—	56	470	168	2 3	—	
3	32	Mrs. M. Connolly,	February	73	6 2	6 12	7	20	24	23	21	23	22	23	21	18	18	9	226	3	—	229	1	51	551	153	2 7	—	(a) 1,254 Eggs
		Carrigamore,	"	74	6 2	7 2	15	6	24	25	24	25	23	25	27	28	25	14	34	207	26	267	—	38	569	114	2 2	—	(b) 27.4 oz.
		Corvalley P.O.,	"	75	5 11	6 12	13	—	—	22	21	20	22	22	19	18	18	9	169	12	3	184	—	10	417	36	2 6	—	(c) 2,782 Points
		Co. Monaghan.	"	76	5 9	6 2	18	—	9	19	18	20	20	18	17	14	4	—	101	48	8	157	21	19	292	57	2 4	—	
			"	77	5 6	5 5	13	11	22	25	23	24	24	23	13	11	16	—	197	5	1	203	1	45	474	135	2 6	—	
			"	78	5 2	6 2	20	—	16	23	23	21	20	22	21	19	19	10	130	73	11	214	—	25	479	75	2 3	—	
4	22	Sister-in-Charge,	Feb. 12	127	5 2	6 15	17	22	16	18	19	20	17	19	16	13	16	6	149	44	6	199	—	50	471	150	2 4	—	(a) 1,200 Eggs
		Rural Domestic Economy School,	"	128	4 8	5 8	15	24	20	18	19	20	17	14	15	4	13	—	172	6	1	179	—	58	431	174	2 6	1	(b) 26 6 oz.
		Swinford,	"	129	4 12	5 14	21	21	14	20	19	23	22	24	23	24	22	11	215	29	—	244	—	56	601	168	2 5	—	(c) 2.761 Points
		Co. Mayo.	"	130	4 8	6 6	—	—	9	18	19	21	21	20	20	21	21	8	33	144	1	178	—	9	412	27	2 2	—	
			"	131	1 8	7 8	—	15	18	22	21	18	21	24	25	21	17	10	70	136	6	212	1	31	434	93	2 3	—	
			"	132	4 8	6 3	—	23	19	22	23	24	22	22	10	8	14	1	29	128	31	188	1	29	362	87	2 1	—	
5	16	Mrs. M. Heverin,	Feb. 16	97	4 13	6 10	—	14	17	5	5	23	25	26	22	24	23	11	16	176	3	195	—	29	471	87	2 2	—	(a) 1,163 Eggs
		Cortoon,	"	98	4 8	5 4	—	5	13	21	23	23	23	24	22	20	19	11	154	49	1	204	—	17	473	51	2 4	—	(b) 27.6 oz.
		Brownsgrove,	"	99	5 4	6 10	21	21	24	17	19	19	20	17	16	9	15	5	137	66	—	203	—	66	501	198	2 4	—	(c) 2,731 Points
		Tuam,	"	100	5 5	5 11	—	—	4	16	22	24	24	23	15	5	21	10	28	132	4	164	—	4	357	12	2 2	1	
		Co. Galway.	"	101	5 7	7 15	19	1	27	24	22	19	21	15	11	5	5	2	139	27	5	171	4	42	376	126	2 5	—	
			"	102	5 5	7 3	19	21	22	21	19	20	22	25	18	18	15	6	226	—	—	226	—	62	553	186	2 10	—	

SECTION II.—WHITE WYANDOTTE—(STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
6	19	Mrs. M. O. Roberts,	Feb. 27	109	6 10	D	4	—	8	10	1	13	D3	—	—	—	—	—	31	6	2	39	—	11	85	33	2 4	—	(a) 1,128 Eggs
		Lakemount,	Jan. 17	110	5 9	6 15	10	23	19	12	17	18	21	20	23	22	19	10	144	69	1	214	—	51	528	153	2 4	—	(b) 25.9 oz.
		Glanmire,	"	111	5 11	7 0	22	16	20	17	18	21	21	24	22	17	15	8	55	158	8	221	5	51	503	153	2 2	—	(c) 2,616 Points
		Co. Cork.	Feb. 2	112	5 8	6 0	18	20	23	15	19	23	22	18	15	14	21	9	10	194	16	220	12	51	475	153	2 1	—	
			Jan. 11	113	5 15	6 9	11	17	18	14	11	16	19	22	22	21	21	11	38	160	5	203	—	45	494	135	2 2	—	
			"	114	7 0	8 13	—	—	18	23	25	25	25	27	28	20	28	12	91	137	3	231	—	15	531	45	2 3	—	
7	29	Miss M. O'Keeffe,	March 9	259	5 4	5 7	9	22	20	18	20	20	20	12	8	3	—	—	131	19	2	152	—	49	352	147	2 5	—	(a) 997 Eggs
		Ballybooden,	"	260	4 12	5 15	24	1	14	22	19	20	19	21	18	20	21	10	169	39	1	209	—	38	505	114	2 5	—	(b) 28.0 oz.
		Knocktopher,	"	261	5 2	5 4	8	4	14	—	—	23	16	—	24	12	18	—	100	18	1	119	1	25	283	75	2 5	—	(c) 2,345 Points
		Co. Kilkenny.	"	262	5 2	6 6	12	17	24	22	23	21	23	22	20	23	19	11	196	44	—	240	—	53	586	159	2 4	—	
			"	263	4 15	6 2	8	3	6	3	14	8	16	12	11	6	9	3	101	—	1	102	6	16	223	48	2 8	—	
			"	264	5 10	5 14	15	9	22	20	21	18	19	16	12	13	10	—	172	2	1	175	10	45	391	126	2 7	—	
8	27	Mrs. J. Scally,	Jan. 12	157	5 0	6 10	12	20	19	23	21	23	25	26	20	17	18	6	31	130	9	230	4	45	515	135	2 2	—	(a) 1,105 Eggs
		Ballyteague,	April 17	158	4 8	5 12	21	20	22	22	21	19	20	21	20	19	24	9	1	162	75	238	—	28	389	84	2 0	—	(b) 25.4 oz.
		Ballycommon,	"	159	4 14	6 14	—	—	—	14	20	18	21	23	17	11	—	—	89	37	1	127	1	—	261	—	2 4	—	(c) 2,227 Points
		Daingean,	"	160	4 8	5 1	1	20	15	19	21	20	22	18	22	21	22	8	6	158	45	209	—	26	390	78	2 1	—	
		Offaly.	"	161	4 8	6 7	18	14	24	23	14	23	18	16	19	16	14	4	144	56	3	203	5	53	475	130	2 1	—	
			"	162	4 14	7 10	—	6	10	17	25	6	16	18	—	—	—	—	45	49	4	98	4	14	194	12	2 3	—	
9	31	Mrs. B. M. J. Condron,	Feb. 15	175	5 0	6 12	20	18	24	21	21	22	16	9	14	6	6	3	120	52	8	180	2	55	110	165	2 4	—	(a) 1,052 Eggs
		Knocktemple,	"	176	5 3	8 5	—	—	5	21	24	23	25	24	23	22	22	12	177	28	—	205	1	5	470	15	2 5	—	(b) 26.5 oz.
		Virginia,	"	177	4 15	6 4	4	17	13	12	18	19	17	11	—	—	22	10	107	49	—	156	—	40	231	120	2 4	—	(c) 2,062 Points
		Co. Cavan.	"	178	4 12	6 7	—	16	27	22	22	22	27	25	25	22	22	11	182	59	—	241	1	43	578	129	2 4	—	
			"	179	4 10	3 13	13	4	—	8	14	13	11	5	—	—	—	—	—	14	57	71	—	7	35	21	1 14	—	
			"	180	5 0	7 6	—	11	19	25	22	23	24	20	19	15	12	9	12	152	35	199	78	20	215	57	2 1	—	
10	14	Mrs. B. Coughlan,	Feb. 2	79	4 9	5 12	11	12	22	21	19	21	23	22	22	20	21	8	45	171	7	223	—	39	520	117	2 2	—	(a) 1,050 Eggs
		Ruane,	"	80	4 12	5 12	17	21	19	18	18	19	20	22	19	18	20	8	—	121	98	219	—	23	299	69	1 15	—	(b) 24.7 oz.
		Eyrecourt,	"	81	4 10	D	13	16	21	17	18	13	10	—	D	—	—	—	13	88	7	108	—	43	245	120	2 1	—	(c) 2,061 Points
		Ballinasloe,	"	82	5 3	6 10	19	22	16	20	17	20	20	16	20	16	18	9	41	160	12	213	—	45	490	135	2 2	—	
		Co. Galway.	"	83	4 10	6 5	14	3	22	17	16	17	21	22	20	22	19	7	39	152	9	200	—	31	469	95	2 2	—	
			"	84	4 10	3 12	13	7	16	7	2	12	10	—	—	—	—	—	1	15	51	67	—	15	47	45	1 12	—	

D = Dead

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival lb.	oz.	Weight: At Close of Test lb.	oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz.	dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
11	23	Mrs. J. O'Connell,	April	133	4	14	6	14	—	—	—	18	19	7	7	—	5	1	1	—	52	6	—	58	2	—	114	—	2	6	—	(a) 894 Eggs
		Ballymaquirk,	"	134	4	12	6	8	—	9	22	19	21	19	21	25	19	14	16	8	101	2	—	193	1	31	452	93	2	8	—	
		Kanturk,	"	135	4	11	6	13	3	13	8	—	3	20	24	24	23	7	22	11	133	24	1	158	—	23	377	69	2	5	—	(b) 27.2 oz
		Co. Cork.	"	136	4	8	5	2	3	20	23	19	20	18	22	18	5	—	—	—	3	125	20	148	—	36	292	108	2	0	—	
			"	137	4	8	6	3	—	—	24	20	21	19	21	20	19	17	17	7	57	96	2	185	—	23	430	69	2	3	—	(c) 2,041 Points
			"	138	4	10	5	6	6	21	21	14	14	12	14	18	6	9	13	4	41	110	1	152	—	48	376	144	2	2	2	
11	28	Mr. W. Barron,	Feb. 11	163	5	7	7	11	—	18	22	21	19	21	19	17	21	18	18	7	187	14	—	201	—	40	485	120	2	6	—	(a) 874 Eggs
		"Woodview,"	"	164	6	0	7	6	13	20	21	18	12	14	19	12	18	9	4	4	69	81	14	164	—	48	365	144	2	3	—	
		Gortrush,	"	165	4	14	D		14	23	21	18	20	17	D	—	—	—	—	—	36	66	11	113	—	48	252	114	2	2	—	(b) 26.7 oz.
		Piltown,	"	166	4	9	D		D4	—	—	—	—	—	—	—	—	—	—	—	—	1	3	4	—	1	3	3	1	14	—	
		Co. Kilkenny.	"	167	5	0	7	0	2	16	21	23	22	26	26	22	26	26	26	12	51	195	2	248	—	38	594	114	2	2	—	(c) 2,041 Points
			"	168	5	2	5	10	7	—	3	21	10	13	16	14	12	23	19	6	117	25	2	144	—	10	342	30	2	5	1	
18	17	Mrs. R. B. Eadie,	Feb. 1	103	7	0	8	5	21	17	15	19	20	19	18	26	23	22	20	8	158	67	3	225	1	51	548	150	2	4	—	(a) 973 Eggs
		The Poplars,	"	104	5	12	6	1	7	22	21	19	18	19	22	12	19	14	10	7	185	5	—	190	—	50	461	150	2	7	1	
		Beaufort,	Feb. 24	105	5	8	D		25	24	17	6	—	D	—	—	—	—	—	—	1	17	54	72	—	18	54	54	1	14	—	(b) 28.5 oz.
		Co. Kerry.	Feb. 11	106	6	0	7	4	15	16	19	15	17	13	23	19	23	21	19	9	181	26	2	209	—	48	511	144	2	6	—	
			"	107	5	9	6	10	11	16	16	15	14	11	13	7	16	16	10	5	8	120	22	150	1	35	314	105	2	1	—	(c) 2 033 Points
			"	108	5	6	D		23	22	2	—	20	25	24	8	—	D	—	—	2	71	51	124	—	4	150	12	1	15	—	
*	21	Mrs. B. Martin,	Feb. 1	121	4	13	6	2	10	20	2	—	6	24	24	22	18	13	23	7	136	27	6	169	—	29	398	87	2	4	1	(a) 896 Eggs
		Corglass,	"	122	5	4	7	0	—	2	15	14	11	13	9	8	8	9	5	5	—	29	70	99	—	2	64	6	1	14	—	
		Kingscourt,	"	123	5	10	6	2	17	21	22	22	21	23	19	21	19	22	21	13	231	10	—	241	—	60	598	180	2	6	—	(b) 26.4 oz.
		Co. Cavan.	"	124	5	4	5	11	19	20	22	25	25	23	24	25	24	16	20	11	183	68	3	254	—	58	607	174	2	4	—	
			"	125	4	11	6	5	8	—	10	3	—	—	3	2	—	—	2	2	1	4	25	30	—	4	14	12	1	13	—	(c) 1,735 Points
			"	126	5	4	D		8	12	4	13	22	19	20	D 5	—	—	—	—	2	24	77	103	—	2	54	6	1	14	—	
14	20	Mrs. E. Hillis,	Jan. 10	115	6	10	7	8	14	14	16	23	25	16	21	20	19	16	14	3	195	4	2	201	8	42	455	126	2	7	—	(a) 660 Eggs
		Corrush,	"	116	5	10	6	12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	
		Doohamlet,	"	117	5	0	6	11	5	—	2	2	—	—	—	—	4	—	—	—	1	3	9	13	—	—	8	—	1	11		(b) 28.3 oz
		Castleblayney,	"	118	5	11	5	4	6	22	7	10	21	16	20	21	16	6	24	2	79	92	—	171	1	35	407	105	2	3	—	
		Co. Monaghan.	"	119	6	11	6	6	12	1	—	2	23	22	21	10	17	—	18	3	127	2	—	129	—	13	292	39	2	8	2	(c) 1,491 Points
			"	120	4	8	6	9	—	14	24	20	19	24	21	17	5	—	1	1	135	10	1	146	—	37	329	111	2	5	—	

* Pen produced more than 20 per cent. of eggs under first grade. D = Dead

SECTION II.—WHITE WYANDOTTE (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen (b) Average Weight per dozen. (c) Scoring Points per Pen.
15	15	Mrs. M. F. Bailey, Shanavaughy House, Ballacolla, Laoighis.	Jan. 30	91	4 13	D	16	20	7	17	11	19	12	11	2	—	D	—	44	57	14	115	—	37	239	111	2 2	—	(a) 549 Eggs
			"	92	4 9	3 4	9	2	20	15	8	11	9	8	4	4	—	—	56	34	—	90	11	31	192	93	2 4	—	
			"	93	5 0	3 14	4	—	—	10	16	21	23	15	13	10	7	8	68	56	6	130	—	1	276	12	2 3	—	(b) 26.3 oz
			"	94	5 3	D	13	—	D	—	—	—	—	—	—	—	—	—	7	6	—	13	—	13	39	39	2 2	—	
			"	95	5 0	4 3	—	—	8	13	—	16	19	21	16	11	10	—	57	55	2	114	—	6	252	24	2 3	—	(c) 1,176 Points
			Feb. 3	96	5 0	D	3	10	13	22	8	15	14	2	—	—	D	—	48	31	8	87	—	20	178	60	2 3	—	

D=Dead

SECTION III.—RHODE ISLAND RED—15 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
1	58	Miss M. O'Donovan, Dromore, Villierstown, Cappoquin, Co. Waterford.	Jan. 28	265	5 6	5 12	13	20	25	21	23	24	27	27	24	21	20	9	27	197	30	254	—	46	542	138	2 1	—	(a) 1,300 Eggs
			"	266	5 0	5 12	11	9	21	24	24	21	22	24	21	21	24	10	84	144	4	232	—	40	550	120	2 3	—	(b) 26.7 oz.
			"	267	5 4	5 8	6	22	19	21	19	22	23	23	24	21	25	12	182	53	2	237	—	45	573	135	2 4	—	(c) 3,247 Points
			"	268	5 0	6 14	—	15	22	22	18	22	22	25	25	23	20	11	222	4	—	226	1	37	541	111	2 8	—	
			"	269	5 0	6 3	13	22	24	24	23	23	24	27	21	21	19	7	82	166	3	251	—	58	601	174	2 3	—	
			"	270	4 14	5 0	8	—	17	17	17	21	22	25	20	17	17	9	80	107	3	190	—	23	440	68	2 3	—	
2	50	Mrs. N. O'Sullivan, Hill View, Clogheen, Clonakilty, Co. Cork.	Mar. 21	217	5 6	5 12	10	19	22	24	26	24	24	25	21	19	19	—	132	99	2	233	—	49	549	147	2 3	—	(a) 1,242 Eggs
			Jan. 21	218	5 6	6 6	8	—	—	4	23	26	26	28	24	21	21	10	45	139	7	191	—	3	422	9	2 2	—	(b) 25.7 oz.
			"	219	5 1	6 14	11	—	—	15	22	24	24	23	6	21	11	11	37	125	6	168	—	7	374	21	2 2	—	(c) 2,782 Points
			"	220	5 5	6 14	5	—	4	26	24	25	26	23	19	12	13	11	13	170	5	188	—	7	400	21	2 2	—	
			Feb. 14	221	5 8	6 0	15	20	23	22	23	19	22	22	23	21	19	8	69	156	12	237	—	46	544	138	2 2	—	
			"	222	5 8	6 4	12	1	20	24	26	23	24	20	24	24	22	5	2	205	18	225	—	23	484	69	2 1	—	
3	55	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.	Feb. 16	193	5 4	7 2	—	6	19	1	12	21	23	18	15	14	10	10	123	23	3	149	—	23	348	69	2 5	1	(a) 1,201 Eggs
			"	194	6 0	6 14	—	19	24	25	19	25	27	25	24	15	19	3	78	147	3	228	—	40	530	120	2 3	—	(b) 26.9 oz.
			"	195	5 4	6 10	1	4	22	22	22	16	20	22	22	22	22	12	108	35	4	207	—	24	486	72	2 5	—	(c) 2,501 Points
			"	196	5 15	6 5	—	—	6	6	25	25	25	25	23	23	11	—	109	58	2	169	18	6	322	18	2 4	—	
			"	197	5 10	6 10	—	13	25	11	7	21	24	20	24	22	24	10	104	105	1	210	—	37	511	111	2 4	—	
			"	198	5 8	6 4	—	13	18	26	23	20	25	24	28	25	25	8	152	105	1	238	64	31	394	93	2 4	—	
4	59	Mrs. K. Earl, Grantstown House, Waterford.	Jan. 25	271	5 1	5 14	—	4	17	22	23	23	22	21	24	23	21	7	135	71	1	207	—	21	483	63	2 4	—	(a) 1,121 Eggs
			Feb. 1	272	5 14	6 12	6	20	19	21	15	20	19	20	16	13	19	7	94	92	9	195	—	38	448	114	2 3	—	(b) 26.7 oz.
			"	273	5 8	7 5	5	20	19	20	19	18	17	11	14	17	9	3	6	131	35	172	1	33	323	96	2 0	—	(c) 2,531 Points
			Jan. 25	274	6 5	7 3	—	—	25	24	21	21	25	19	14	15	16	1	152	28	1	181	—	25	416	75	2 5	1	
			"	275	6 0	7 6	—	7	20	19	21	17	22	19	12	17	17	5	126	49	1	176	—	26	415	78	2 4	—	
			"	276	5 12	7 6	2	15	22	21	19	19	17	23	22	10	15	7	151	39	—	190	1	39	446	117	2 5	—	
5	60	Miss J. Weston, Ballymadrough, Donabate, Co. Dublin.	Mar. 21	277	5 4	6 8	11	—	18	20	18	20	22	23	21	19	20	10	175	27	—	202	—	29	482	87	2 5	—	(a) 1,091 Eggs
			April 20	278	5 14	7 14	6	—	9	23	26	25	24	26	28	25	23	11	157	61	8	226	1	7	499	21	2 5	—	(b) 27.4 oz.
			Mar. 21	279	5 12	7 6	21	15	—	—	—	21	15	19	1	17	11	6	118	8	—	126	1	36	320	108	2 7	3	(c) 2,475 Points
			"	280	5 12	6 0	17	—	—	21	26	14	26	28	20	23	7	—	49	124	9	182	1	11	334	33	2 2	1	
			"	281	5 15	7 0	15	—	1	21	22	21	22	24	16	19	13	5	51	115	13	179	—	4	373	12	2 2	1	
			"	282	5 5	6 12	20	13	—	—	20	22	25	23	21	12	11	9	178	3	—	176	—	33	417	99	2 6	2	

SECTION III.—RHODE ISLAND RED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1948	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec 23	Dec. 24–Jan. 20	Jan 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14 May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weigh per dozen. (c) Scoring Points per Pen.
6	49	Mrs. K. Sammon,	Feb. 14	211	5 15	6 14	12	14	22	22	22	20	18	15	2	—	—	—	143	3	1	147	1	48	338	144	2 7	—	(a) 1,296 Eggs
		Carrigahorig,	”	212	4 10	5 10	16	15	8	17	21	22	24	26	25	22	24	11	164	76	1	231	1	39	551	117	2 4	—	
		Lorrha,	”	213	5 8	D	17	19	17	17	20	21	24	21	7	D3	—	—	165	1	—	166	3	33	381	159	2 9	—	(b) 27.2 oz.
		Birr,	”	214	4 12	5 14	21	18	21	21	19	21	20	23	19	20	19	10	176	56	—	232	103	60	318	180	2 4	—	
		Offaly.	”	215	5 2	6 3	21	22	23	21	21	28	28	24	21	22	14	9	37	213	7	257	1	66	605	198	2 2	—	(c) 2,465 Points
			”	216	5 8	6 15	16	22	21	26	24	26	24	23	23	23	25	10	71	188	4	263	153	57	269	171	2 3	—	
7	53	Mrs. J. McCarthy,	Feb. [illegible]	235	4 12	5 3	—	15	23	23	25	26	26	25	23	5	24	12	157	70	—	227	—	38	533	114	2 5	—	(a) 1,059 Eggs
		Caherelly Castle,	”	236	5 14	D	—	—	12	23	21	23	22	17	2	D	—	—	9	110	1	120	—	11	219	32	2 2	—	
		Grange,	”	237	5 7	6 10	12	20	20	23	20	21	21	21	16	17	9	7	118	87	2	207	—	51	493	153	2 4	—	(b) 26.0 oz.
		Kilmallock,	”	238	5 8	5 10	18	14	20	18	14	16	21	17	2	—	—	—	3	95	42	140	—	28	224	84	2 0	2	
		Co. Limerick.	”	239	5 14	6 12	18	21	21	19	20	21	23	25	17	20	19	7	99	122	8	229	1	54	539	159	2 3	—	(c) 2,208 Points
			”	240	5 2	D	11	23	22	23	19	19	16	3	D	—	—	—	9	103	24	136	—	36	260	108	2 1	—	
8	51	Mrs. K. Cuddihy,	Feb. 15	223	6 2	7 3	5	—	—	18	21	22	26	25	9	14	12	13	11	146	8	165	—	5	357	15	2 2	1	(a) 1,040 Eggs
		Hillside P.F.,	”	224	5 6	6 10	5	22	21	20	21	19	18	19	16	11	14	6	148	44	3	195	—	45	163	195	2 4	—	
		Glenmore,	”	225	5 6	5 13	7	—	11	21	22	24	20	22	8	9	23	3	158	12	—	170	1	18	291	54	2 7	2	(b) 27.1 oz.
		Co. Kilkenny.	”	226	6 3	7 7	3	8	25	19	23	22	18	13	8	7	—	—	92	54	—	146	1	36	333	109	2 4	—	
			”	227	6 6	8 12	8	3	23	20	23	11	12	8	6	3	—	—	114	6	—	120	—	34	277	102	2 7	—	(c) 2,273 Points
			”	228	5 6	6 3	9	5	21	24	21	22	26	23	21	20	9	2	46	150	8	204	—	29	452	87	2 2	—	
9	48	Mrs. D. Philpott,	April	205	5 10	6 11	12	—	15	20	18	18	21	22	21	21	21	10	161	20	15	199	—	12	152	36	2 4		(a) 956 Eggs
		Charlesfield,	”	206	5 13	6 6	14	22	16	18	11	19	17	17	16	13	7	8	13	134	31	178		29	51	87	2 1		
		Banteer,	”	207	5 2	D	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		—	(b) 26.7 oz.
		Co. Cork.	”	208	6 12	7 4	5	1	22	20	10	6	23	21	22	19	20	10	121	51	7	182	—	31	120	33	2 4	—	
			”	209	6 12	7 12	2	—	—	15	22	22	24	26	21	26	24	11	192	4	—	196	—	2	453	6	2 7		(c) 2,168 Points
			”	210	5 12	5 14	—	—	7	24	23	25	20	26	26	20	21	9	12	186	3	201	—	4	150	12	2 2	—	
10	54	Mrs. E. O'Donnell,	Jan. 28	241	5 10	D	6	21	D10	—	—	—	—	—	—	—	—	—	31	3	—	37	—	37	111	111	2 5	—	(a) 1,066 Eggs
		Kilbreedy West,	”	242	5 2	6 10	—	8	15	15	15	18	21	21	23	24	16	6	147	35	3	185	—	29	430	60	2 5	—	
		Kilmallock,	”	243	5 5	7 5	9	1	19	19	23	24	26	21	20	27	22	10	7	189	28	224	—	26	465	73	2 1	—	(b) 25.3 oz.
		Co. Limerick.	”	244	5 7	7 10	17	4	19	24	29	26	27	25	23	23	23	9	25	155	60	240	—	25	405	75	2 1	—	
			”	245	5 6	8 3	15	4	14	21	24	20	22	24	18	8	3	2	52	120	3	175	6	73	372	66	2 3	—	(c) 2,052 Points
			”	246	5 4	7 2	20	11	22	20	12	18	21	22	22	21	13	3	1	107	97	205	—	8	251	24	1 15	—	

D = Dead

SECTION III.—RHODE ISLAND RED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs laid in Pen. (b) Average Weight per dozen (c) Scoring Points per Pen
11	52	Mrs. K. Cuddihy, Hillside P.F., Glenmore, Co. Kilkenny	Feb. 15	229	5 9	D	—	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(a) 902 Eggs
			,,	230	5 1	6 14	—	1	25	25	21	25	24	29	17	23	22	11	37	177	4	215	—	23	507	60	2 2	—	(b) 26 4 oz.
			,,	231	5 6	6 14	21	—	—	14	25	27	27	23	12	—	2	1	51	85	13	152	1	13	292	39	2 2	—	(c) 2,011 Points
			,,	232	5 14	6 10	10	—	23	21	21	21	27	23	28	24	25	12	79	149	10	238	—	32	544	96	2 3	—	
			,,	233	5 4	6 14	—	11	21	4	17	26	12	16	10	9	9	13	62	81	5	148	—	31	246	93	2 3	—	
			,,	234	5 3	6 6	—	7	17	10	16	22	24	25	11	7	2	—	143	3	—	146	1	24	322	72	2 7	—	
12	47	Mr. M. Fitzgibbon, Gurrane, Kilmeedy, Co. Limerick.	March 26	199	6 2	7 7	16	4	—	9	20	23	21	17	15	15	14	7	107	53	4	164	2	20	374	60	2 4	—	(a) 841 Eggs
			,,	200	5 12	D	17	4	D	—	—	—	—	—	—	—	—	—	7	11	3	21	—	18	51	51	2 0	—	(b) 26 [illegible] oz.
			,,	201	5 12	6 0	—	—	22	26	14	27	26	26	28	24	24	12	115	82	3	200	—	23	535	69	2 4	—	(c) 1,9[illegible] Points
			,,	202	6 4	7 0	—	—	1	23	21	21	25	26	12	20	7	13	68	98	4	170	—	1	373	3	2 3	—	
			,,	203	5 8	5 14	—	—	—	10	14	20	22	22	20	8	14	2	58	74	—	132	—	—	258	—	2 3	—	
			,,	204	4 12	6 0	—	—	4	20	—	20	21	22	21	18	20	5	40	112	2	154	3	4	341	12	2 3	—	
13	57	Lady M. Athlumney, Somerville, Balrath, Co Meath.	Feb. 27	181	5 14	D	10	—	7	10	D	—	—	—	—	—	—	—	17	9	1	27	—	16	68	48	2 5	—	(a) 739 Eggs
			,,	182	5 6	D	7	5	16	6	2	13	17	14	6	D	—	—	—	17	69	86	—	3	37	9	1 14	—	(b) 26 6 oz.
			,,	183	5 4	6 9	—	10	21	18	21	19	21	21	17	22	20	7	12	173	12	197	1	26	442	78	2 2	—	(c) 1,598 Points
			,,	184	5 3	5 10	17	19	23	22	19	20	20	20	21	15	19	10	171	53	1	225	1	58	547	174	2 4	—	
			,,	185	5 12	4 0	19	2	5	16	9	2	6	9	9	6	9	—	43	50	2	95	—	25	226	75	2 3	—	
			,,	186	5 15	6 0	16	17	21	20	21	7	—	—	—	8	—	—	108	1	—	109	3	53	278	150	2 9	—	
14	56	Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.	February	253	5 7	D	—	—	—	8	22	26	23	26	23	D6	—	—	43	75	16	134	—	—	237	—	2 2	—	(a) 715 Eggs
			,,	254	4 10	5 10	3	12	1	22	20	5	26	26	8	19	11	6	63	88	8	159	—	16	354	48	2 3	1	(b) 26 7 oz.
			March	255	4 10	6 5	4	12	21	18	15	19	24	23	22	24	22	8	184	27	1	212	—	36	512	105	2 6	—	(c) 1,518 Points
			February	256	4 13	4 9	4	—	6	16	14	7	17	7	13	11	3	—	52	39	10	101	16	10	160	30	2 2	—	
			,,	257	5 3	D	2	16	19	22	22	11	—	—	—	—	—	—	81	10	1	92	—	36	218	108	2 5	—	
			,,	258	5 2	D	—	—	10	7	D	—	—	—	—	—	—	—	2	12	3	17	—	9	37	27	2 1	—	
15	61	Mrs. A. M. Lynch, Athgoe Villa, Straffan, (Co. Dublin).	March 8	283	5 0	7 10	—	—	11	18	15	12	19	21	17	14	13	4	141	3	—	144	4	11	321	33	2 14	—	(a) 553 Eggs
			,,	284	4 10	3 13	14	15	17	9	8	22	20	20	14	9	4	—	15	113	24	152	1	37	296	111	2 1	—	(b) 27 2 oz.
			,,	285	4 10	7 0	—	6	24	24	21	20	24	18	11	13	15	6	12	153	17	182	—	30	390	90	2 1	—	(c) 1,173 Points
			,,	286	4 12	D	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
			,,	287	5 0	D	—	16	18	16	6	3	—	D	—	—	—	—	10	47	2	59	—	34	143	102	2 2	—	
			,,	288	4 14	D	16	—	—	—	D	—	—	—	—	—	—	—	—	6	10	16	—	6	18	18	1 14	—	

D = Dead

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS) - 20 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight On Arrival lb. oz	Weight At Close of Test lb. oz.	Eggs Laid Oct. 1-Oct. 28	Oct. 29-Nov 25	Nov. 26-Dec 23	Dec. 24-Jan 20	Jan. 21-Feb. 17	Feb. 18-Mar. 16	Mar. 17-Apl. 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug 3	Aug. 4-Aug. 17	Eggs per Bird Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1-Dec. 23	Scoring Points per Bird Full Period	Oct 1-Dec. 23	Average Weight of Eggs per Bird oz. dr	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen
1	82	Miss M. Mulcahy,	February	397	4 13	7 3	12	22	20	4	9	21	23	25	24	22	21	10	145	62	6	213	1	49	513	147	2 4	--	(a) 1,225 Eggs
		Abbey View,	,,	398	5 13	7 8	23	12	2	18	21	22	25	22	27	24	23	12	61	166	8	235	1	30	541	90	2 2	—	(b) 27 1 oz
		Clonmel,	,,	399	5 0	6 15	18	20	13	2	17	21	25	23	21	24	22	10	69	140	10	219	—	55	523	165	2 2	-	
		(Co. Waterford.)	,,	400	4 11	6 3	—	3	19	18	17	20	21	25	23	17	21	8	67	121	4	192	—	21	442	63	2 3	- -	
			,,	401	4 14	5 12	11	16	18	15	18	20	23	25	10	15	8	5	184	3	—	187	—	48	450	141	2 7	1	(c) 2,896 Points
			,,	402	4 12	7 6	—	11	20	8	18	20	23	25	16	18	14	6	176	3	-	179	—	31	427	93	2 8	- -	
2	81	Mrs. B. M. Rafter,	Feb. 19	415	4 13	5 13	15	--	20	19	16	17	18	27	26	24	21	12	13	184	18	215	- -	23	474	69	2 1	- -	(a) 1,179 Eggs
		Knockthomas,	,,	416	4 12	6 10	17	--	15	21	21	22	25	20	25	22	19	9	144	72	—	216	- -	32	514	96	2 4	- -	
		Nurney,	,,	417	5 0	6 2	17	—	5	20	24	26	26	24	24	18	19	5	76	130	2	208	3	22	470	66	2 3	—	(b) 26 9 oz.
		Bagnalstown,	,,	418	5 2	5 13	—	-	18	22	11	7	22	12	20	15	6	8	80	54	5	139	- -	18	309	54	2 4	1	
		Co. Carlow	,,	419	5 8	6 14	—	—	5	22	22	23	21	25	23	22	23	10	197	2	—	199	- -	5	455	15	2 7	—	(c) 2,691 Points
			,,	420	5 2	6 0	10	—	5	13	19	19	26	25	24	23	22	11	151	46	2	202	1	13	406	39	2 4	-	
*	68	Mrs. B. McAuliffe,	Feb. 20	325	4 14	5 14	18	22	19	19	19	20	22	16	11	16	13	8	4	144	55	203	—	12	345	36	2 0	-	(a) 1,417 Eggs
		Farrihy,	,,	326	5 9	6 6	24	25	20	20	18	19	21	21	21	22	24	10	97	144	8	249	-	60	598	180	2 3		
		Broadford,	,,	327	4 13	6 6	—	-	20	24	26	25	26	27	27	26	25	11	1	19	217	237	- -	1	43	3	1 14	-	(b) 25 4 oz
		Charleville,	,,	328	5 4	6 6	4	21	21	22	25	26	26	24	25	21	19	9	171	73	2	246	- -	15	584	135	2 4		
		(Co. Limerick).	,,	329	5 3	6 2	- -	14	23	20	22	26	28	26	27	25	27	13	19	206	26	251	---	37	532	111	2 1		(c) 2,671 Points
			,,	330	5 11	6 13	18	22	20	18	21	21	22	23	16	21	20	9	217	13	1	231	-	59	560	177	2 5		
3	80	Miss M. O'Donovan,	Jan. 28	385	5 5	6 0	14	22	21	14	-	11	24	26	12	10	14	8	178	1	—	179	- -	57	417	171	2 8	-	(a) 1,252 Eggs
		Dromore,	,,	386	5 2	6 8	--	11	25	23	22	23	24	25	25	21	19	9	19	175	38	230	-	39	462	117	2 1	-	
		Villierstown,	,,	387	5 5	6 10	14	20	21	18	15	20	21	20	19	18	17	8	207	3	1	211		54	517	162	2 9		(b) 28.7 oz.
		Cappoquin,	,,	388	5 15	6 13	16	—	22	2[illegible]	19	22	23	24	23	10	11	-	197	5	---	202	--	38	472	114	2 8		
		Co. Waterford.	,,	389	5 10	5 15	15	20	20	22	21	21	17	17	16	13	17	4	203	—	- -	205	110	55	211	165	2 3		(c) 2,659 Points
			,,	390	4 14	5 14	- -	22	23	24	24	23	21	19	21	15	16	10	101	119	1	227	6	45	520	155	2 5		
4	78	Mrs. L. Hayes,	Feb. 1	379	5 12	5 14	8	- -	19	18	23	21	24	23	23	22	20	10	194	17	---	211	--	27	501	81	2 [illegible]		(a) 1,094 Eggs
		Walshestown,	,,	380	5 14	6 10	--	—	14	19	18	19	23	23	24	23	21	9	189	4	---	193	-	14	453	32	2 7	—	
		Castlemahon,	Feb. 23	381	5 8	6 5	4	4	23	10	15	22	16	8	13	4	-	-	79	39	1	119	1	20	262	90	2 1	-	(b) 28 1 oz.
		Newcastle West,	,,	382	4 15	6 4	—	13	21	19	20	1	20	10	15	15	13	1	124	22	2	148	—	31	353	102	2 6	1	
		Co. Limerick.	,,	383	5 9	7 0	6	—	12	21	20	22	24	24	21	19	19	9	191	3	-	197	---	18	159	51	2 9	- -	(c) 2,570 Points
			,,	384	5 7	7 6	11	--	25	23	19	23	23	25	21	21	23	12	177	48	1	226	—	36	542	103	2 5	-	

*Pen produced more than 20 per cent of eggs under first grade.

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS)—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight On Arrival lb. oz.	Weight At Close of Test lb. oz.	Eggs Laid Oct. 1-Oct. 28	Oct. 29-Nov. 25	Nov. 26-Dec. 23	Dec. 24-Jan. 20	Jan. 21-Feb. 17	Feb. 18-Mar. 16	Mar. 17-Apl. 13	Apl. 14-May 11	May 12-June 8	June 9-July 6	July 7-Aug. 3	Aug. 4-Aug. 17	Eggs per Bird Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1-Dec. 23	Scoring Points per Bird Full Period	Oct. 1-Dec. 31	Average Weight of Eggs per Bird oz. d.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen
5	74	Mrs. M. F. Smith,	Feb.-Mar.	355	6 5	7 10	20	16	22	21	20	22	16	—	2	—	—	--	132	7	--	139	-	58	380	174	2 7	—	(a) 1,098 Eggs
		Bridge House,	,,	356	5 13	7 5	25	24	22	21	26	22	11	12	12	4	15	9	107	73	3	183	--	68	452	204	2 3	—	
		Bettystown,	,,	357	5 0	6 5	—	13	22	21	20	24	26	24	25	24	25	11	66	166	3	235	—	35	557	105	2 3	--	(b) 26 4 oz.
		Co. Meath.	,,	358	5 2	6 4	—	—	14	18	22	21	25	21	24	22	22	11	8	140	50	198	—	11	341	35	2 1	—	
			,,	359	5 5	7 2	16	1	—	—	—	21	20	18	15	15	15	6	30	87	10	127	1	11	277	33	2 2	3	(c) 2,501 Points
			,,	360	5 6	5 13	19	16	19	18	17	16	19	20	20	21	22	9	172	44	—	216	—	54	538	162	2 4	--	
	64	Mrs. K. Sammon.	Feb. 14	301	5 8	6 13	13	16	17	15	20	20	19	21	5	7	—		98	52	6	156	1	41	314	123	2 4	—	(a) 1,099 Eggs
		Carrigaborig,	,,	302	4 12	6 1	18	3	3	20	20	22	20	—	—	5	6	5	103	18	1	122	--	28	281	69	2 4	---	
		Lorrha,	,,	303	4 15	5 6	21	20	20	17	19	18	18	22	19	16	8	--	12	153	33	198	--	36	302	114	2 1	1	(b) 27 2 oz
		Birr,	,,	304	5 7	6 6	14	9	23	5	13	23	24	20	18	13	15	12	177	10	2	189	—	45	459	135	2 6	2	
		Offaly	,,	305	6 12	7 10	18	4	5	20	20	21	21	23	21	25	20	10	208	1	—	209	--	27	498	81	2 9	—	(c) 2,493 Points
			,,	306	4 8	5 4	16	17	22	20	18	21	23	24	24	22	12	6	14	203	8	225	2	51	519	152	2 1	---	
7	67	Mrs. E. O'Donnell,	Jan. 28	319	5 9	7 0	24	22	23	19	16	20	21	23	19	19	4	—	42	140	28	210	-	41	428	123	2 1	—	(a) 1,065 Eggs
		Kilbreedy West,	,,	320	5 6	6 15	22	15	20	21	20	19	23	22	17	—	12	—	156	34	1	191	—	57	449	171	2 4	1	
		Kilmallock,	,,	321	5 5	6 14	14	1	2	18	20	23	26	26	21	19	19	16	144	54	1	199	6	17	443	51	2 4	—	(b) 26.7 oz.
		Co. Limerick	,,	322	4 8	5 8	—	2	—	—	3	6	11	10	12	9	12	1	4	48	14	66	—	2	124	6	2 1	—	
			,,	323	5 4	6 5	19	16	19	18	19	20	22	22	20	20	20	9	172	50	2	224	—	54	546	162	2 4	—	(c) 2,410 Points
			,,	324	5 4	6 4	9	4	16	12	7	21	19	24	22	12	19	10	152	23	—	175	—	29	420	87	2 5	—	
8	70	E. Bean Mhic Dhomhnaill,	Jan. 27	331	5 0	5 5	22	19	20	19	22	23	22	26	24	22	12	5	7	204	26	237	—	47	504	141	2 1	--	(a) 1,097 Eggs
		Imeall Atha,	,,	332	5 3	7 5	8	—	19	22	22	20	25	24	24	22	17	2	113	87	5	205	—	22	463	66	2 4	--	
		Baile an Fheirteirigh,	Feb. 20	333	5 0	6 6	20	10	3	18	23	23	27	25	26	26	22	12	83	138	14	235	—	25	524	75	2 2	--	(b) 26 3 oz.
		Co. Chiarraidhe.	Jan. 27	334	1 15	6 6	19	20	19	7	2	15	20	18	22	21	11	9	78	104	2	184	51	57	338	171	2 3	—	
			,,	335	5 0	6 12	9	--	15	19	22	24	27	21	28	24	24	13	223	6	—	229	--	24	543	72	2 6	—	(c) 2,390 Points
			Feb. 20	336	5 5	D	D 7	—	—	—	—	—	—	--	—	—	—	—	—	6	1	7	—	6	18	18	1 15	—	
*	66	Mrs. J. McCarthy,	Feb. 13	313	5 11	6 6	—	—	15	20	21	21	25	26	21	18	12	10	43	139	7	189	—	13	417	39	2 2	1	(a) 1,248 Eggs
		Caberelly Castle,	,,	314	5 1	6 10	23	23	27	24	21	22	23	20	17	14	11	1	—	37	187	224	—	4	81	12	1 14	—	
		Grange,	,,	315	5 2	7 3	17	21	21	20	19	23	23	24	21	15	26	3	200	26	1	227	1	59	546	177	2 5	—	(b) 25.0 oz.
		Kilmallock,	,,	316	5 6	6 6	—	—	12	22	23	22	23	27	23	23	23	12	36	169	5	210	—	11	479	33	2 2	---	
		Co. Limerick.	,,	317	5 0	5 0	14	14	—	18	20	23	24	25	24	17	5	—	—	53	131	184	—	2	116	6	1 15	—	(c) 2,126 Points
			,,	318	4 14	6 11	18	24	19	22	23	20	18	19	18	13	12	8	26	177	11	214	2	53	487	159	2 1	—	

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS) continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival (lb. oz.)	Weight: At Close of Test (lb. oz.)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
9	84	Miss J. Weston,	March 12	409	7 3	8 3	6	–	14	21	22	24	23	17	25	23	22	10	179	24	4	207	–	16	477	18	2 5	–	(a) 1,003 Eggs
		Ballymadrough,	" 21	410	5 14	6 2	9	1	24	23	21	25	23	20	25	22	23	9	40	182	9	231	—	25	523	75	2 2	–	
		Donabate,	" 12	411	7 8	8 13	14	–	–	20	20	18	20	15	7	5	2	1	121	1	–	122	1	14	264	42	2 11	–	(b) 26 8 oz
		Co. Dublin.	"	412	6 0	D	d16	–	–	–	–	–	–	–	–	–	–	–	—	10	6	16	—	10	30	30	1 15	–	
			Feb. 24	413	6 0	6 14	14	–	–	3	20	14	26	28	24	22	25	10	157	29	–	186	–	14	413	42	2 5	—	(c) 2,063 Points
			March 21	414	5 12	6 13	20	–	18	24	25	24	26	26	24	22	22	10	3	129	109	241	—	10	326	30	2 0	–	
10	63	Mrs. D. Philpott,	April	295	7 2	7 4	18	20	20	22	15	16	21	18	21	21	21	8	215	6	—	221	–	58	550	171	2 7	–	(a) 832 Eggs
		Charlesfield,	"	296	5 15	7 0	—	7	21	22	3	19	23	23	24	21	22	2	123	64	2	189	1	30	446	90	2 4	—	
		Banteer,	"	297	6 12	D	4	—	–	18	9	18	20	18	17	–	D	—	52	49	3	104	—	4	206	12	2 4	–	(b) 27 7 oz.
		Co. Cork.	"	298	6 8	7 6	7	—	—	—	5	24	25	24	19	25	25	12	152	14	–	166	1	7	398	21	2 5	—	
			"	299	6 4	4 0	20	24	21	8	2	1	25	22	15	—	—	—	114	23	1	138	—	61	338	192	2 5	—	(c) 1,068 Points
			"	300	6 4	D	11	—	–	D	–	–	–	—	—	—	—	—	3	7	4	14	—	10	30	30	2 0	—	
11	73	Mrs. M. Brennan,	Jan. 20	349	4 13	5 11	—	–	—	13	15	16	24	25	15	24	17	10	19	136	7	162	1	–	358	–	2 2	—	(a) 835 Eggs
		Drummond,	"	350	5 2	6 14	15	11	15	14	15	19	20	20	17	10	—	–	66	86	4	156	1	38	350	111	2 3	—	
		St. Mullins,	"	351	4 11	6 9	—	18	19	19	18	17	21	15	26	15	23	6	187	10	–	197	—	37	475	111	2 6	–	(b) 27.4 oz
		Co. Carlow.	"	352	4 12	5 14	14	11	6	16	15	17	18	9	—	—	8	6	114	5	1	120	—	20	282	90	2 8	3	
			"	353	4 8	4 0	—	3	15	7	2	2	8	–	—	–	—	–	3	28	6	37	—	16	78	48	2 1	–	(c) 1,957 Points
			"	354	5 7	6 12	19	19	20	12	–	12	16	13	14	15	15	8	154	8	1	163	—	57	419	171	2 5	–	
12	76	Miss A. T. Brennan,	March 1	367	5 12	6 13	16	18	22	21	23	22	21	16	19	13	5	1	1	70	126	197	4	9	[illegible]	27	1 15	—	(a) 969 Eggs
		Coolsilla,	"	368	6 6	D	18	17	19	20	19	19	21	d11	—	–		–	126	3	1	140	–	49	327	117	2 6	—	
		Thomastown,	"	369	5 12	D	18	20	20	18	19	22	21	24	21	22	d10	—	180	22	3	215	–	55	511	165	2 4	–	(b) 26.9 oz.
		Co. Kilkenny.	"	370	5 12	6 10	16	8	2	1	—	—	12	18	16	17	4	1	20	52	23	95	7	25	169	75	2 2	—	
			"	371	5 10	6 6	12	21	10	10	11	11	14	7	9	5	4	–	61	52	1	114	1	42	275	126	2 3	–	(c) 1,942 Points
			Feb. 28	372	5 5	7 2	15	23	19	19	20	9	22	22	14	12	26	7	203	2	3	208	—	54	509	162	2 8	2	
13	71	Mr. W. Murphy,	Feb. 28	373	5 10	D	19	16	5	—	21	27	d11	–	–	—	—	–	69	27	3	99	–	37	229	111	2 5	—	(a) 810 Eggs
		Skeeter Park,	Feb. 5	374	5 14	D	3	17	12	6	21	1	—	D	—	—	—	—	25	28	7	60	—	29	135	57	2 3	—	
		Cleariestown,	Feb. 23	375	5 10	6 14	22	20	21	13	7	19	22	20	15	18	23	9	168	37	2	207	–	61	521	183	2 5	1	(b) 26.5 oz.
		Co. Wexford.	"	376	5 8	6 10	23	21	19	17	19	23	22	24	19	20	18	8	167	64	2	233	—	62	570	186	2 4	–	
			March 8	377	6 2	7 5	17	—	—	4	25	22	25	26	27	25	22	9	13	153	34	200	—	4	581	12	2 1	–	(c) 1,839 Points
			"	378	5 10	D	19	D 1	–	–	—	—	—	—	—	–	–	—	—	–	20	20	–	–	–	–	1 13	–	

D = Dead

SECTION IV.—RHODE ISLAND RED (STATION HOLDERS) continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1948	No. of Bird	Weight: On Arrival lb. oz	Weight: At Close of Test lb. oz	Eggs Laid: Oct. 1–Oct. 28	Oct 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen (c) Scoring Points per Pen.
14	83	Miss C. Mealiff,	Jan 28	403	5 11	4 0	18	19	21	18	19	12	12	19	12	16	13	—	60	112	7	179	—	53	426	159	2 2	—	(a) 785 Eggs
		Ballinamona House,	Feb. 20	404	5 10	D	—	10	19	19	17	—	D	—	—	—	—	—	40	25	—	65	—	29	159	87	2 4	—	(b) 26 6 oz
		Tullamore,	,,	405	6 5	6 15	18	17	3	16	13	19	22	21	20	21	16	7	191	1	1	193	—	37	465	111	2 7	—	(c) 1,780 Points
		Offaly.	,,	406	5 10	D	19	3	17	21	23	20	16	9	—	—	D	—	4	98	26	128	—	30	234	90	2 0	—	
			,,	407	5 9	D	14	—	21	14	—	2	1	D	—	—	—	—	36	11	5	52	—	32	126	96	2 3	—	
			,,	408	5 15	5 15	16	—	11	19	7	22	26	21	17	11	11	5	67	93	6	166	—	26	370	78	2 3	—	
*	62	Mrs. M. Browne,	Feb. 20	289	4 14	6 8	20	—	20	23	22	22	22	21	18	17	4	—	—	82	107	189	—	2	174	6	1 15	—	(a) 979 Eggs
		Ballybane,	,,	290	4 10	6 0	9	16	21	20	20	21	22	22	20	19	20	9	102	109	8	219	—	38	508	114	2 3	—	(b) 25 8 oz
		Firies,	,,	291	4 14	6 15	1	2	1	3	5	5	9	6	—	—	—	—	7	25	—	32	—	4	68	12	2 2	—	(c) 1,734 Points
		Co. Kerry.	,,	292	4 8	5 12	—	11	21	19	20	21	23	20	14	17	19	7	1	68	123	192	1	9	157	27	1 15	—	
			,,	293	5 14	7 8	—	6	21	20	22	21	17	12	2	2	15	6	115	29	—	144	—	27	338	81	2 5	—	
			,,	294	4 11	5 14	—	9	20	18	9	20	23	25	25	21	22	11	202	1	—	203	—	29	489	87	2 7	—	
15	65	Mrs. E. Hammersley,	Jan. 21	307	5 6	6 6	13	—	—	15	15	25	23	23	21	18	14	9	125	35	6	176	9	13	363	39	2 5	—	(a) 689 Eggs
		Ashvale,	,,	308	5 4	6 11	20	22	23	22	22	20	22	15	10	12	18	9	210	5	—	215	—	65	534	195	2 7	—	(b) 27.7 oz
		Lattin,	,,	309	5 7	D	7	19	19	17	10	—	D	—	—	—	—	—	47	25	—	72	—	45	189	135	2 3	—	(c) 1,636 Points
		Tipperary.	,,	310	5 6	D	D8	—	—	—	—	—	—	—	—	—	—	—	6	1	1	8	—	7	21	21	2 4	—	
			,,	311	5 0	D	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
			,,	312	4 15	5 10	17	20	21	21	23	24	23	21	9	19	20	—	147	70	1	218	1	58	529	174	2 4	1	
16	*75	Mrs. N. Smyth,	Feb. 8	361	5 6	6 13	11	4	24	23	24	25	27	27	22	19	25	9	194	45	1	240	—	29	570	117	2 5	—	(a) 735 Eggs
		Kilcloon,	,,	362	4 11	D	d13	—	—	—	—	—	—	—	—	—	—	—	—	2	11	13	—	2	6	6	1 13	—	(b) 26 5 oz
		Dunboyne,	,,	363	4 8	6 9	7	1	24	23	20	21	23	24	23	24	25	11	158	68	—	226	—	32	541	98	2 4	—	(c) 1,626 Points
		Co. Meath.	,,	364	5 3	D	7	D	—	—	—	—	—	—	—	—	—	—	1	4	2	7	—	5	15	15	1 15	—	
			,,	365	5 9	6 12	17	—	18	25	28	24	19	20	18	17	12	6	57	144	3	204	30	33	399	99	2 2	—	
			,,	366	4 15	D	12	2	22	8	—	—	1	D	—	—	—	—	2	30	13	45	—	28	92	84	2 0	—	
*	72	Mrs. M. C. McCormack,	Feb. 7	313	5 9	5 14	23	22	19	20	20	18	20	11	11	7	4	—	8	126	41	175	—	30	369	99	2 0	—	(a) 1,262 Eggs
		Bawnogues P.F.,	,,	344	5 0	6 2	25	23	23	23	22	22	22	25	15	24	17	9	—	36	214	250	—	4	87	12	1 14	—	(b) 21 2 oz
		Kilcock,	,,	345	5 4	5 6	19	17	9	6	18	18	21	25	18	17	18	9	52	132	11	195	—	42	447	126	2 2	—	(c) 1,547 Points
		Co. Kildare.	,,	346	5 6	6 0	13	21	15	18	16	17	20	20	16	12	1	—	22	102	45	169	1	25	286	75	2 0	—	
			,,	347	4 13	5 10	23	26	22	23	25	25	22	26	23	17	19	9	—	168	92	260	113	25	138	75	2 0	—	
			,,	348	5 6	6 10	2	21	21	20	16	21	21	24	21	18	21	7	51	153	9	213	79	36	286	108	2 2	—	

*Pen produced more than 20 per cent. of eggs under first grade. D=Dead

SECTION V.—ANY NON-SITTING BREED—10 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1948	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 10	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 22	Scoring Points per Bird: Full Period	Oct. 1–Dec. 22	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen
1	93	*White Leghorn*	March 1	469	4 0	4 10	25	15	24	17	23	24	26	27	25	21	15	8	1	71	178	250	—	14	164	42	1 15	—	(a) 1,381 Eggs
		Sister-in-Charge,	"	470	4 5	5 0	24	15	21	20	17	20	19	18	17	15	11	2	42	142	15	199	—	45	141	135	2 [illegible]	—	
		Rural Domestic Economy School, Swinford,	"	471	4 6	4 15	23	17	21	18	21	21	22	22	23	21	18	8	120	114	1	235	—	60	575	150	2 3	—	(b) 25 6 oz
		Co. Mayo.	"	472	4 0	5 0	22	21	21	20	22	22	24	22	20	24	23	13	17	189	48	254	—	35	507	105	2 1	—	
			"	473	4 6	4 14	20	20	18	18	25	23	22	22	22	20	23	11	166	75	1	242	—	57	593	171	2 4	—	(c) 2,768 Points
			"	474	4 0	5 4	21	24	19	20	19	19	19	20	15	13	11	1	178	22	1	201	—	63	488	180	2 5	—	
2	100	*White Leghorn*	Jan. 10	427	4 0	4 15	9	18	18	17	18	18	20	19	15	16	18	6	174	18	—	192	18	45	415	81	2 6	—	(a) 1,107 Eggs
		Mrs. M. O'Shea,	" 16	428	3 13	4 6	12	12	20	19	19	20	21	21	25	23	20	10	149	67	6	222	—	38	523	111	[illegible] 4	—	
		Farrantane,	"	429	4 0	5 9	16	17	15	11	5	20	16	14	11	13	2	7	136	11	—	147	—	48	364	141	2 6	—	(b) 26 9 oz.
		Castlegregory	Jan. 10	430	3 8	4 6	15	19	17	19	17	18	23	21	25	20	16	9	62	153	4	219	—	49	523	147	2 2	—	
		Co. Kerry.	"	431	3 8	3 11	13	14	12	14	13	12	17	16	11	15	3	—	89	53	1	143	—	39	341	117	2 4	—	(c) 2,583 Points
			"	432	3 10	4 13	—	4	19	16	19	22	21	21	16	20	17	9	45	133	6	184	1	18	417	54	2 2	—	
3	92	*White Leghorn*	Jan. 25	463	4 0	4 12	12	18	8	13	11	20	22	16	16	11	7	1	153	2	—	155	—	38	367	114	2 7	—	(a) 1,078 Eggs
		Sister-in-Charge,	Mar. 18	464	4 2	6 0	13	19	20	19	20	24	25	24	19	17	—	9	22	146	41	209	—	27	387	81	2 2	—	
		St. Martha's College,	"	465	3 12	D	11	18	20	18	15	17	20	D 7	—	—	—	—	28	87	11	126	—	39	269	117	2 2	—	(b) 27 1 oz
		An Uaimh,	Feb. 23	466	4 4	4 9	5	12	18	18	17	21	23	21	17	11	12	—	162	13	—	175	—	35	408	105	2 5	—	
		Co. Meath.	"	467	4 0	4 2	11	21	5	18	19	22	25	22	23	21	19	5	204	7	—	211	—	37	504	111	2 6	—	(c) 2,118 Points
			Mar. 18	468	3 15	5 0	4	17	17	16	20	22	23	23	19	14	13	9	94	108	—	202	—	38	483	114	2 3	—	
4	87	*White Leghorn*	March 16	433	3 12	5 2	20	18	18	14	20	19	14	18	8	20	15	6	118	66	6	190	1	53	458	156	2 3	—	(a) 1,042 Eggs
		Mrs. P. Kelly,	"	434	3 8	4 4	12	19	19	16	16	18	20	21	23	9	20	13	56	140	10	206	—	41	475	123	2 2	—	
		Mount Mary,	"	435	3 8	5 3	—	3	6	12	14	11	20	19	19	7	6	4	121	—	—	121	—	9	208	27	2 9	—	(b) 27 1 oz.
		Ballygar,	"	436	3 8	4 15	—	10	15	21	20	22	22	24	22	20	17	9	187	14	1	202	—	25	472	75	2 6	—	
		Co. Galway.	"	437	3 2	3 8	—	7	14	12	13	19	19	20	21	16	2	—	91	51	1	143	—	20	322	60	2 4	—	(c) 2,391 Points
			"	438	3 7	4 4	—	11	7	16	18	12	23	20	21	19	21	9	54	114	12	180	—	14	396	42	2 2	—	
5	88	*White Leghorn*	March 31	439	4 3	5 10	18	10	18	9	14	16	22	21	22	18	18	6	173	17	2	192	—	45	467	135	2 6	—	(a) 1,191 Eggs
		Mrs. M. J. Smith,	"	440	4 10	5 10	12	16	23	21	19	21	23	23	19	21	16	1	39	161	15	215	—	38	476	114	2 2	—	
		Colmanstown,	"	441	3 11	5 5	—	10	15	13	11	18	20	18	17	17	12	2	60	84	9	153	—	22	341	66	2 3	—	(b) 25.6 oz.
		Ballinasloe,	"	442	4 3	5 10	14	21	20	20	20	22	18	18	16	10	5	6	12	163	15	190	—	44	415	132	2 1	—	
		Co. Galway.	"	443	4 0	5 7	8	20	20	19	21	18	25	25	23	21	23	10	115	114	4	233	—	44	556	132	2 3	—	(c) 2,378 Points
			"	444	3 14	4 12	16	17	14	19	21	20	20	17	20	17	15	12	2	46	160	208	—	10	123	30	1 14	—	

D = Dead

SECTION V.—ANY NON-SITTING BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1918	No. of Bird	Weight: On Arrival (lb. oz)	Weight: At Close of Test (lb. oz)	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird (oz. dr.)	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
6	90	*White Leghorn* Mrs. A. Collins, Imanemore, Barnaderg, Co. Galway.	April 28	451	3 6	D	—	2	16	21	D 4	—	—	—	—	—	—	—	35	8	—	43	—	18	104	54	2 5	—	(a) 921 Eggs
			,,	452	3 0	5 10	—	—	—	6	17	17	20	18	17	17	16	7	132	3	—	135	—	—	310	—	2 7	—	(b) 27 8 oz.
			,,	453	3 4	6 4	—	—	—	15	17	23	21	22	19	23	24	11	169	7	1	177	—	—	410	.	2 6	—	(c) 2,142 Points
			,,	454	3 4	5 2	—	—	17	21	22	25	18	15	18	22	19	11	171	17	—	191	—	17	451	51	2 6	—	
			,,	455	3 0	5 6	—	—	9	19	26	21	21	21	22	20	22	9	98	35	1	134	—	9	426	27	2 4	—	
			,,	456	3 4	5 4	—	—	12	21	21	23	24	23	20	21	18	8	127	61	—	191		12	441	26	2 4	—	
7	94	*White Leghorn* Miss E. Fennell, Burtown House, Ballytore, Co. Kildare.	March 7	475	4 8	5 2	12	6	19	20	22	25	24	11	5	—	—	—	6	101	37	144	—	8	222	24	2 0	—	(a) 941 Eggs
			,,	476	4 0	3 14	2	14	15	15	13	17	11	7	2	2	9	—	79	28	3	110	—	31	254	93	2 4	—	(b) 27 8 oz.
			,,	477	4 8	4 13	7	15	15	18	16	20	22	18	8	10	18	9	175	1	—	176	11	37	302	102	2 9	—	(c) 2,009 Points
			,,	478	4 12	5 5	7	15	19	9	16	19	17	19	14	15	15	8	169	4	—	173	—	41	425	123	2 7	—	
			,,	479	4 0	5 2	—	—	1	17	17	19	20	23	20	17	6	—	137	3	—	140	5	1	291	3	2 7	—	
			,,	480	4 0	4 10	12	22	20	3	18	21	22	24	19	18	17	2	70	121	7	198	15	48	422	99	2 3	—	
8	86	*White Leghorn* Miss A. Fitzgerald, Ardgoul, Rathkeale, Co. Limerick.	March	421	3 12	D	—	—	13	13	23	21	417	—	—	—	—	—	60	27	—	87	—	13	187	59	2 5	—	(a) 903 Eggs
			,,	422	4 0	4 1	6	17	18	13	19	18	20	22	20	11	—	—	21	113	30	164	—	30	303	90	2 1	—	(b) 25 7 oz.
			,,	423	3 8	3 13	—	16	17	20	19	23	20	24	17	5	—	—	2	94	65	161	—	13	200	39	2 0	—	(c) 1,800 Points
			,,	424	3 9	4 7	11	9	23	22	20	20	25	23	22	21	20	10	19	176	31	226	—	27	463	81	2 1	—	
			,,	425	3 9	D	—	—	17	14	D 5	—	—	—	—	—	—	—	31	5	—	36	—	17	89	51	2 8	—	
			,,	126	4 8	4 13	6	18	19	18	19	23	24	25	23	21	23	10	186	41	2	229	—	11	549	123	2 4	—	
*	91	*White Leghorn* Rev. Bro. Dominick, Agricultural College, Mountbellew, Co. Galway.	March	457	3 4	3 12	9	19	20	13	15	18	24	24	14	8	14	—	34	144	5	183	—	45	123	135	2 2	—	(a) 928 Eggs
			,,	458	3 6	4 10	14	4	5	17	9	5	—	—	—	—	—	—	1	32	21	54	—	4	70	12	2 0	—	(b) 25 5 oz.
			,,	459	4 8	5 4	6	8	—	5	18	15	18	21	17	19	21	9	74	83	—	157	—	14	377	42	2 3	—	(c) 1,725 Points
			,,	460	3 7	4 10	—	12	19	19	20	20	19	20	19	—	19	10	66	109	2	177	—	30	408	90	2 3	—	
			,,	461	3 8	3 8	15	3	3	19	20	22	21	24	24	18	17	3	1	24	164	189	—	5	57	15	1 13	—	
			,,	462	3 8	4 0	—	14	16	22	21	16	21	23	11	14	10	—	158	10	—	168	—	30	390	90	2 6	—	
*	89	*White Leghorn* Mrs. M. Hanly, Cooga, Doon, Co. Limerick.	April 27	445	3 8	4 11	—	8	5	18	20	22	24	15	19	22	21	9	—	63	120	183	—	9	140	27	1 15	—	(a) 783 Eggs
			,,	446	3 8	4 10	—	15	10	18	18	21	21	18	17	20	18	9	63	111	11	185	—	18	411	54	2 3	—	(b) 25.1 oz.
			,,	447	3 8	4 7	—	—	7	19	20	15	20	25	17	2	—	—	—	93	32	125	—	6	193	18	2 0	—	(c) 1,334 Points
			,,	448	4 0	D	D 7	—	—	—	—	—	—	—	—	—	—	—	—	—	7	7	—	—	—	—	1 12	—	
			,,	449	3 8	4 10	—	11	21	20	19	21	15	21	10	3	21	9	8	142	25	175	—	23	352	69	2 1	—	
			,,	450	3 12	4 10	—	—	9	17	17	17	15	11	9	7	6	—	101	7	—	108	—	9	238	27	2 6	—	

*Pen produced more than 20 per cent. of eggs under first grade. D = Dead.

SECTION VI.—ANY OTHER UTILITY BREED—18 Pens.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct 29–Nov. 25	Nov. 26–Dec 23	Dec. 24–Jan. 20	Jan. 21–Feb 17	Feb. 18–Mar. 16	Mar. 17–Apl 13	Apl 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug 3	Aug. 4–Aug 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct 1–Dec 23	Scoring Points per Bird: Full Period	Oct 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
1	117	*Light Sussex* Mrs. M. Comferford,	Jan. 15	571	6 0	6 3	21	19	22	17	18	20	22	23	21	24	22	7	1	114	121	236	—	4	270	12	1 15	—	(a) 1,105 Eggs
		Lamogue,	"	572	5 10	6 11	18	16	18	17	16	21	23	21	21	20	23	5	176	43	—	219	1	52	535	156	2 4	—	
		Windgap,	"	573	5 7	6 8	23	21	21	22	16	20	22	19	6	16	1	4	44	144	3	191	3	65	456	195	2 2	—	(b) 25 6 oz.
		Co. Kilkenny.	"	574	5 4	6 15	21	19	23	11	7	6	—	—	—	—	—	—	13	64	10	87	1	54	206	162	2 1	—	
			"	575	5 3	5 10	20	1	3	15	19	16	17	12	9	17	14	8	13	127	11	151	—	17	334	51	2 2	3	(c) 2,354 Points
			"	576	5 2	6 5	15	21	18	18	18	21	24	27	11	22	16	10	147	74	—	221	—	54	544	162	2 4	1	
*	107	*Light Sussex* Mrs. M. Keatley,	Jan. 29	511	5 10	6 4	19	16	19	20	22	22	24	25	16	22	23	1	104	121	4	229	—	52	548	156	2 3	—	(a) 1,236 Eggs
		Boakefield,	"	512	5 2	6 11	2	23	23	21	20	20	20	15	17	16	18	7	40	156	6	202	7	47	460	141	2 2	—	
		Ballytore,	"	513	5 12	5 1	18	19	22	18	17	17	21	20	2	19	5	10	1	99	88	188	—	19	256	57	1 15	2	(b) 24 8 oz.
		Co. Kildare.	"	514	5 12	6 13	26	24	19	23	20	24	24	23	21	16	10	6	12	173	21	236	1	52	510	156	2 2	—	
			"	515	5 6	8 4	16	21	19	19	21	19	19	21	22	21	18	8	4	117	103	224	1	7	289	21	1 15	—	(c) 2,352 Points
			"	516	5 4	7 6	20	7	—	1	21	20	23	15	11	16	9	11	8	120	29	157	—	20	309	60	2 1	2	
2	108	*Light Sussex* Sister-in-Charge,	Feb. 23	517	5 14	6 5	18	21	8	11	18	17	21	14	9	19	13	4	21	136	16	173	—	39	384	117	2 1	1	(a) 1,055 Eggs
		St. Martha's College,	"	518	5 4	5 15	6	25	24	21	20	19	20	18	17	13	20	7	137	72	1	210	—	55	515	165	2 4	—	
		An Uaimh,	Jan. 25	519	5 13	7 15	—	—	14	20	20	21	24	24	22	19	14	7	—	164	21	185	—	9	371	27	2 0	—	(b) 26.5 oz.
		Co. Meath.	"	520	5 8	6 2	19	22	22	21	18	18	23	15	12	7	14	7	192	6	—	198	3	63	180	189	2 6	—	
			"	521	5 14	7 4	—	2	25	23	21	21	25	16	5	14	13	3	48	115	5	168	18	25	335	75	2 3	—	(c) 2,315 Points
			Jan. 10	522	5 12	6 10	—	—	—	17	17	18	20	22	14	11	2	—	116	5	—	121	9	—	232	—	2 6	—	
3	115	*Light Sussex* Mrs. M. Riordan,	Jan. 22	559	6 7	7 9	12	12	16	18	17	14	15	20	15	10	16	7	91	77	4	172	—	39	106	117	2 4	—	(a) 1,037 Eggs
		Glenleigh,	"	560	6 0	6 7	11	19	16	19	18	22	17	20	17	17	19	11	24	160	22	206	—	37	448	111	2 1	—	
		Clogheen,	"	561	5 10	6 3	19	6	13	14	22	23	25	25	15	15	15	5	102	93	2	197	—	37	462	111	2 3	1	(b) 26.0 oz.
		Co. Tipperary.	"	562	5 14	8 14	11	24	22	21	23	18	15	14	11	5	—	—	51	110	3	164	—	56	383	168	2 3	—	
			"	563	6 0	6 8	—	—	—	18	11	23	24	23	21	12	18	5	13	104	38	155	—	—	267	—	2 1	—	(c) 2,299 Points.
			"	564	5 14	8 13	8	17	14	13	7	15	15	16	19	19	—	—	93	46	4	143	1	39	333	117	2 1	—	
4	118	*Buff Rock* Mrs. A. Coleman,	Feb. 26	481	5 13	7 2	2	11	13	8	18	19	22	23	21	20	18	10	168	13	4	185	—	22	132	66	2 5	—	(a) 945 Eggs
		Ballycullen House,	"	482	6 2	7 14	16	16	21	19	19	18	20	19	14	8	7	6	145	38	—	183	—	53	410	159	2 5	—	
		Croom,	"	483	5 8	5 12	18	3	3	15	21	21	24	11	22	10	18	11	145	31	2	178	—	23	111	69	2 5	1	(b) 28.0 oz.
		Co. Limerick.	"	484	5 0	5 2	6	4	20	18	21	25	22	18	6	20	9	11	51	124	5	180	—	26	416	78	2 2	2	
			March 10	485	4 13	D	—	—	2	10	17	18	18	6	—	—	D	—	69	2	—	71	6	2	132	6	2 7	—	(c) 2,196 Points
			"	486	5 6	7 6	6	17	20	12	14	14	16	12	12	10	11	4	147	1	—	148	1	43	362	129	2 9	—	

*Pen produced more than 20 per cent. of eggs under first grade. D=Dead.

SECTION VI.—ANY OTHER UTILITY BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1942	No. of Bird	Weight On Arrival lb. oz.	Weight At Close of Test lb. oz.	Eggs Laid Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar 16	Mar. 17–Apl. 13	Apl. 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
5	103	*Light Sussex* Miss B. Roche,	Feb. 2	487	5 0	5 11	—	—	19	15	13	19	13	6	16	11	12	1	18	64	7	119	—	8	259	24	2 3	3	(a) 1,068 Eggs
		Cleariestown,	,,	488	5 7	5 8	—	3	20	17	19	18	20	20	13	15	9	8	70	90	2	162	—	1	373	63	2 3	—	(b) 25.3 oz.
		Co. Wexford.	,,	489	5 8	6 8	12	11	19	21	18	19	15	15	15	17	13	7	2	127	53	182	—	13	296	39	2 0	—	(c) 2,186 Points
			,,	490	4 12	6 1	4	11	20	22	20	20	15	21	22	20	21	10	10	161	35	206	—	33	418	99	2 1	—	
			,,	491	5 0	6 3	—	18	23	23	20	24	22	24	23	19	11	4	5	169	37	211	2	30	406	90	2 1	—	
			,,	492	5 8	6 7	6	—	20	20	19	19	23	25	22	19	7	8	110	77	1	188	—	26	434	78	2 4	—	
6	116	*Light Sussex* Mrs. A. Quilty,	Feb. 15	565	5 2	7 4	—	—	3	21	23	21	21	22	4	22	17	8	29	132	1	162	—	3	372	9	2 2	1	(a) 1,004 Eggs
		Nicholastown,	,,	566	5 8	7 5	—	12	23	21	21	23	22	21	21	18	7	8	167	30	—	197	—	35	162	105	2 4	—	(b) 25.7 oz.
		Mooncoin,	,,	567	6 0	7 1	17	17	23	21	15	22	16	11	18	9	13	10	3	176	13	192	9	50	119	150	2 1	1	(c) 2,185 Points
		Co. Kilkenny.	,,	568	5 3	6 4	—	—	—	12	18	22	27	14	15	17	19	4	18	114	16	148	—	—	300	—	2 2	3	
			,,	569	4 12	5 8	—	8	16	11	21	20	24	18	16	11	21	1	6	129	32	167	—	16	313	18	2 0	1	
			,,	570	6 3	6 14	22	—	—	18	21	5	19	17	12	15	13	—	87	49	2	138	—	21	319	63	2 4	2	
7	114	*Light Sussex* Sister-in-Charge,	Feb. 2	553	5 14	7 3	—	—	—	21	20	15	19	20	23	23	17	9	157	7	3	167	1	—	371	—	2 6	—	(a) 979 Eggs
		St. Mary's Abbey,	,,	554	5 8	D	9	12	20	20	20	11	1	1	1	D	—	—	68	27	—	95	1	11	229	123	2 1	—	(b) 26.4 oz.
		Glencairn,	,,	555	5 8	6 12	1	12	28	23	21	21	27	26	24	21	25	12	17	172	48	237	—	38	457	114	2 1	—	(c) 2,164 Points
		Co. Waterford.	,,	556	5 13	5 7	20	20	22	22	20	19	16	20	8	20	17	5	55	146	8	209	—	54	498	162	2 2	—	
			Feb. 14	557	6 0	7 7	2	—	—	7	25	20	25	15	3	9	16	5	60	66	1	127	2	1	277	3	2 3	—	
			,,	558	6 4	6 8	11	14	19	18	13	16	11	16	10	2	9	5	94	43	7	144	6	12	319	126	2 5	—	
8	102	*Light Sussex* Miss M. Daly,	Jan. 13	577	4 12	5 8	—	—	5	19	22	22	17	20	22	23	20	3	31	135	7	173	—	4	380	12	2 2	—	(a) 947 Eggs
		Knockglass,	,,	578	5 3	D	—	—	—	20	20	22	20	23	D	—	—	—	54	57	—	111	1	—	220	—	2 3	—	(b) 26.9 oz.
		Moynalty,	,,	579	5 3	6 2	—	9	20	17	11	5	13	16	8	13	21	9	137	8	—	145	—	29	362	87	2 6	1	(c) 2,125 Points
		Ceanannus Mor,	,,	580	5 0	6 1	—	—	—	6	22	20	22	25	24	21	20	9	77	88	4	169	—	—	380	—	2 3	—	
		Co. Meath.	March 1	581	5 0	5 10	—	—	1	20	21	23	10	22	21	11	—	5	65	79	2	116	—	—	307	—	2 3	—	
			,,	582	5 3	6 3	—	—	19	19	20	23	22	26	23	21	22	8	171	32	—	203	—	19	476	57	2 5	—	
9	109	*Light Sussex* Mrs. M. Nagle,	March 16	523	5 12	6 12	20	4	24	12	20	24	23	15	22	16	13	11	37	159	8	204	—	12	472	126	2 2	1	(a) 897 Eggs
		Springmount,	Feb. 6	524	6 3	6 10	21	8	21	22	23	23	22	23	18	19	19	8	214	12	1	227	—	49	547	147	2 5	—	(b) 26.4 oz.
		Mallow,	,,	525	6 6	D	—	—	—	—	—	—	—	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	(c) 2,117 Points
		Co. Cork.	March 16	526	6 [illegible]	D	23	19	9	9	6	1	6	D	—	—	—	—	34	27	12	73	—	51	173	153	2 1	—	
			,,	527	5 9	7 7	22	12	21	20	18	20	17	22	20	17	17	9	162	48	5	215	2	50	508	150	2 4	—	
			Feb. 6	528	5 12	5 13	17	9	19	18	18	29	22	18	8	18	11	—	17	156	5	178	—	42	417	126	2 2	1	

SECTION VI.—ANY OTHER UTILITY BREED—continued.

Order of Merit	Number of Pen	Name and Address of Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec. 23	Dec. 24–Jan. 20	Jan 21–Feb 17	Feb. 18–Mar. 16	Mar. 17–Apl. 13	Apl 14–May 11	May 12–June 8	June 9–July 6	July 7–Aug. 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen.
10	106	*Light Sussex* Mrs. K. Cuddihy, Hillside P. F., Glenmore, Co. Kilkenny.	Feb. 15	505	5 0	5 11	—	11	22	10	21	22	17	18	20	10	16	3	9	127	48	184	2	30	321	90	2 0	1	(a) 1,015 Eggs
			,,	506	6 4	6 6	13	—	18	17	18	22	24	19	13	11	15	1	65	105	1	171	—	30	397	90	2 3	—	(b) 25.1 oz.
			,,	507	5 5	7 0	5	7	23	20	21	20	18	22	11	15	17	6	3	153	32	188	—	24	376	72	2 1	—	(c) 2,015 Points
			,,	508	5 0	6 2	6	8	22	22	21	23	37	26	23	9	—	—	6	113	63	187	—	34	287	102	2 0	—	
			,,	509	6 0	6 14	11	—	7	1	13	16	15	13	15	10	17	3	63	54	4	121	—	18	222	51	2 3	3	
			,,	510	6 4	7 10	9	18	20	16	15	12	20	14	6	8	13	10	68	88	8	164	—	10	332	120	2 3	—	
11	111	*Light Sussex* Mrs. J. Hely-Hutchinson, Lissen Hall, Swords, Co. Dublin.	February	535	5 12	5 10	13	—	6	21	21	25	24	24	12	21	21	3	1	174	16	191	—	15	406	15	2 1	—	(a) 913 Eggs
			,,	536	6 11	8 4	15	8	29	20	11	23	25	23	24	18	15	12	64	113	9	216	7	41	481	123	2 2	—	(b) 25.6 oz.
			,,	537	5 14	6 10	13	18	13	18	16	21	22	20	18	19	4	7	71	119	—	193	—	49	464	147	2 3	—	(c) 1,963 Points
			,,	538	5 10	5 15	16	—	—	8	18	25	23	23	—	11	11	2	2	128	10	140	—	10	295	30	2 1	1	
			,,	539	6 13	8 13	8	—	4	16	23	26	13	7	2	—	9	10	41	63	8	115	13	8	209	24	2 3	—	
			,,	540	5 12	7 4	—	—	—	3	21	7	12	3	4	—	7	—	37	20	1	58	—	—	108	—	2 5	—	
12	101	*Light Sussex.* Mrs. W. O'Neill, Killeen House, Ballybricken, Grange, Kilmallock, Co. Limerick.	Jan. 18	589	5 10	7 1	14	—	5	19	27	25	22	11	19	16	17	12	11	156	23	190	—	14	391	42	2 1	1	(a) 972 Eggs
			,,	590	6 6	5 14	6	—	11	26	21	15	14	11	11	8	17	8	34	96	27	157	—	11	299	33	2 2	1	(b) 24.9 oz.
			,,	591	5 9	6 15	10	18	20	20	22	23	23	15	16	15	19	8	19	170	20	209	—	41	457	133	2 1	—	(c) 1,872 Points
			,,	592	5 14	6 7	17	—	—	15	23	15	19	19	11	11	16	13	2	67	93	162	—	14	176	12	1 15	1	
			,,	593	5 4	D	11	—	—	21	19	15	3	—	—	—	—	D	—	55	14	69	—	5	115	15	2 0	—	
			,,	594	5 12	6 2	—	18	19	20	22	20	20	22	9	16	15	4	75	107	3	185	—	37	131	111	2 3	—	
13	113	*Light Sussex* Mrs. D. Martin, Kilkeelan, Athboy, Co Meath.	March 28	547	5 6	8 0	—	—	10	17	19	17	21	23	12	11	16	8	123	22	6	151	—	10	330	30	2 5	1	(a) 825 Eggs
			,,	518	5 9	7 14	—	—	12	21	13	19	18	18	13	12	7	10	35	104	7	146	—	10	316	30	2 3	3	(b) 26.1 oz.
			,,	549	5 5	6 6	10	3	22	21	18	19	22	11	10	12	18	1	47	109	17	173	—	23	368	60	2 2	2	(c) 1,692 Points
			,,	550	5 10	6 14	—	—	12	23	8	21	21	19	20	19	22	10	75	98	1	174	1	12	105	36	2 3	—	
			,,	551	5 4	5 14	—	—	3	18	13	21	7	21	4	14	18	1	30	68	13	120	1	—	241	—	2 3	—	
			,,	552	5 4	D	10	—	22	11	12	4	2	—	—	—	D	—	1	12	48	61	—	6	32	18	1 14	—	
14	112	*Light Sussex* Mrs. M. Doyle, Glencorrig, Shinrone, Offaly.	Feb. 25	541	5 14	6 10	17	4	21	1	11	16	12	14	11	16	17	6	59	88	8	155	—	41	373	123	2 3	3	(a) 823 Eggs
			,,	542	6 1	6 4	—	5	21	16	—	1	17	3	14	—	6	6	27	55	7	89	—	25	201	75	2 2	1	(b) 25.7 oz.
			,,	543	4 8	6 1	—	—	—	16	14	10	22	21	11	16	10	6	1	57	80	138	—	—	138	—	1 15	1	(c) 1,581 Points
			,,	544	5 4	6 6	—	—	13	17	18	13	9	16	23	9	16	2	62	70	9	141	—	13	302	39	2 3	—	
			,,	545	5 14	6 13	—	—	14	15	19	17	22	16	14	16	15	13	152	8	1	161	2	13	371	39	2 6	—	
			,,	546	5 6	6 15	13	—	1	23	15	11	21	10	15	11	9	10	4	83	52	139	—	2	196	6	2 0	1	

D = Dead

SECTION VI.—ANY OTHER UTILITY BREED—continued.

Order of Merit	Number of Pen	Name and Address Owner	Date of Hatching in 1943	No. of Bird	Weight: On Arrival lb. oz.	Weight: At Close of Test lb. oz.	Eggs Laid: Oct. 1–Oct. 28	Oct. 29–Nov. 25	Nov. 26–Dec 23	Dec. 24–Jan. 20	Jan. 21–Feb. 17	Feb. 18–Mar. 16	Mar. 17 Apl. 13	Apl. 14 May 11	May 12–June 8	June 9–July 6	July 7 Aug 3	Aug. 4–Aug. 17	Eggs per Bird: Special Grade	First Grade	Under First Grade	Total	Defective Special and First Grade	Special and First Grade—Oct. 1–Dec. 23	Scoring Points per Bird: Full Period	Oct. 1–Dec. 23	Average Weight of Eggs per Bird oz. dr.	Number of times Broody	(a) Total Eggs from Pen. (b) Average Weight per dozen. (c) Scoring Points per Pen
5	104	*Light Sussex* Mrs. N. O'Sullivan, Hill View, Clogheen, Clonakilty, Co. Cork.	Feb. 14	493	5 2	6 4	16	—	—	13	26	23	21	20	12	—	19	—	44	82	24	150	—	14	285	42	2 3	3	(a) 672 Eggs
			"	494	5 4	5 10	—	—	—	6	21	18	11	14	13	—	13	—	81	15	—	96	1	—	202	—	2 6	3	(b) 26.5 oz.
			"	495	5 3	6 7	—	—	18	22	20	12	12	10	7	2	—	—	61	42	—	103	—	18	226	54	2 4	—	(c) 1,460 Points
			"	496	5 2	6 1	—	—	—	—	14	22	4	20	—	4	16	11	11	70	10	91	—	—	184	—	2 1	1	
			Feb. 21	497	5 11	6 14	22	22	22	19	21	22	23	17	22	15	12	9	119	100	1	220	—	65	354	195	2 3	—	
			"	498	5 3	D	3	D	—	—	—	—	—	—	—	—	—	—	2	1	—	3	—	3	9	9	2 9	—	
16	105	*Light Sussex* Mrs. N. O'Sullivan, Hill View, Clogheen, Clonakilty, Co. Cork.	Jan. 21	499	5 5	5 2	17	—	—	—	13	17	7	18	1	17	—	—	31	57	2	90	—	17	210	51	2 2	1	(a) 693 Eggs
			"	500	5 14	7 6	2	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	1 12	—	(b) 26.1 oz
			"	501	5 11	6 12	15	—	—	19	25	25	22	25	13	18	15	7	5	111	70	184	—	1	259	3	2 0	2	(c) 1,407 Points
			"	502	6 0	6 6	17	—	10	21	13	23	15	13	13	12	9	4	140	8	2	150	—	27	347	81	2 6	1	
			"	503	6 0	6 10	17	18	23	20	21	11	19	15	15	3	14	4	118	57	5	180	—	56	426	168	2 4	—	
			"	504	5 8	7 13	9	1	17	19	11	2	13	8	7	—	—	—	34	35	18	87	—	27	165	81	2 2	—	
17	110	*Light Sussex* Miss M. Mullen, Lisaniskea, Clara, Offaly.	Feb. 15	529	5 8	7 10	—	—	—	—	—	—	—	—	—	2	—	1	—	1	2	3	—	—	3	—	1 14	—	(a) 636 Eggs
			"	530	5 11	7 0	8	—	3	24	22	21	20	17	6	8	3	1	100	27	6	133	13	5	236	15	2 6	—	(b) 27 1 oz.
			"	531	5 7	D	d19	—	—	—	—	—	—	—	—	—	—	—	8	10	1	19	—	18	54	54	2 2	—	(c) 1,379 Points
			"	532	5 4	6 6	—	—	17	16	18	21	18	13	17	12	12	—	11	122	11	144	6	16	289	48	2 2	—	
			"	533	5 10	7 6	13	—	—	18	22	24	23	12	22	19	26	13	149	43	—	192	—	13	455	39	2 5	—	
			"	534	5 0	6 6	—	—	—	15	5	6	24	21	22	19	22	11	102	43	—	145	—	—	342	—	2 4	—	

D = Dead.

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ÉIRE

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THE DEVELOPMENT OF WHEAT GROWING IN ÉIRE IN RECENT YEARS AND THE EXTENSION OF MILLING STORAGE AND DRYING FACILITIES.

If the middle-aged man-in-the-street were asked what fundamental difference there is between his daily bread of to-day and that of his youth he would probably say that he has not noticed any difference. Yet, twenty years ago a considerable proportion of the flour used in Éire was milled overseas, while all the wheat from which it was obtained was grown thousands of miles from this country, some of it even as far away as Australia. To-day, not only is all our flour milled in this country, but the bulk of it comes from wheat grown in our own fields.

A good idea of what led up to this change and much interesting information as to the state of wheat production and flour milling in Ireland over a period going back almost a century can be got by glancing through a few comparatively recent and very interesting reports which are probably quite unknown to the great majority of people. These are a Report of the Tariff Commission (Report No. 3) dated April, 1928, on an application from the Irish Flour Millers' Association for a 3/- per sack tariff on imported flour, the Majority and Minority Interim Reports of the Economic Committee, 1928, dated April, 1929, on wheat-growing and on the question of a tariff on flour and the Report of the Prices Commission, dated July, 1934, on their investigation into the prices charged for wheaten flour manufactured in this country. We learn that in 1847, still known as the famine year, the area under wheat in the thirty-two counties of Ireland was some 670,000 acres, slightly more than the 642,000 acres grown in the Twenty-Six Counties in 1944. As can be ascertained, however, by reference to the Statistical Abstract published by the Department of Industry and Commerce, the yield was substantially less than at present, and it is probable that most of the wheat was exported to Great Britain to feed the expanding industrial population of that country while the potato remained the staple food of our own agricultural community. Hence the famine when the potato crop failed. Following the famine years the population fell steadily during the remainder of the century. So did the area under wheat, the acreage in the Twenty-Six Counties dropping from nearly 429,000 in 1851 to less than 60,000 in 1891 and to just over 31,000 in 1901. The Twenty-Six County figure remained about the thirty-thousands until the food production campaign during the Great War of 1914-18 brought it up to 136,000, but when that war came to an end the wheat acreage decreased rapidly until in 1928, the year of the Tariff Commission's report, it was back to the 31,000 acres of the opening year of the century. In the middle

twenties it fell as low as 22,000 acres and was again down to that figure in the year 1932 which, as will be seen, marked a change in Government policy in regard to wheat-growing in Éire.

Many factors contributed to the great alteration in the attitude of Irish farmers to wheat-growing during the period reviewed in the previous paragraph. Emigration from this and other European countries led to the opening up of great areas of prairie soil and the clearing and cultivation of timber lands in North America and Australia; this in turn enabled vast quantities of wheat to be produced on those virgin soils with a minimum of labour and attention. It was the period of development of railways in America and the traffic provided by the increased production of the new settlers encouraged the building of railway systems on a trans-continental scale to bring the wheat to ports on the Great Lakes and the seaboard, whence either the grain, or the flour milled from it, could be cheaply transported and delivered to this and other European countries at prices with which farmers operating under the conditions obtaining in this country could not compete. Cattle production and dairying, with markets at home and in the more and more thickly populated industrial cities of Great Britain, seemed more attractive to Irish farmers, while maize from South America provided a cheap feeding stuff. In these circumstances farmers here turned their attention from wheat to other aspects of farming.

Improvements in milling processes, particularly the development of the modern roller flour mill, and the invention of a process of whitening flour without interfering with its quality, also made it impossible for the old water-driven stone mills in this country to compete with the excellent, cheap, and attractively white flour milled in Canada and Great Britain and transported to this country at very low freights. The derelict mills to be seen everywhere in various stages of decay during the first quarter of the present century and then, in many cases, disappearing altogether from the landscape, told their own story of the great change in conditions brought about in this country during the industrial age.

The Irish millers did not, however, let their foreign competitors have things altogether their own way ; modern roller-milling plants were set up at several of our ports to which ocean-going steamers could bring cargoes of wheat, and even in inland districts enterprising millers, though depending mainly on imported wheat, were able to modernise their mills, maintain themselves against the competition of flour milled outside this country, and even keep alive locally the tradition of wheat-growing. But there were casualties ; and the pressure of outside competition urged the Irish Flour Millers' Association in 1927 to ask for a protective tariff of 3/– per sack on imported flour. This, the Tariff Commission of the day did not see fit to recommend.

In 1932 there was a change, already referred to, in Government policy in

the direction of making this country more independent of outside sources of supply as regards its requirements of foods and feeding stuffs. Not only was it decided to revive interest in wheat-growing and tillage generally, but also to provide for the milling at home of our total flour requirements instead of importing flour milled abroad. As an immediate relief to the existing mills an import duty of 5/- per sack (280 lb.) was imposed on flour imported on or after 7th July, 1932, while legislation to give effect to the new policy was being planned and enacted. Subsequent to the report of the Tariff Commission in 1928 there had been a period of several years of over-production of wheat in the principal producing countries with the result that wheat prices on the world market had fallen greatly. For some years prior to 1928 the average price in this country of imported wheat had been upwards of 30/- c.i.f. per barrel of 280 lb., but the price had fallen steadily in the years that followed and in 1933 became less than 15/- per barrel. While such prices afforded this country an opportunity of enjoying cheap flour and bread, even with the addition of the 5/- import duty on flour, they made the growing of wheat for sale on a competitive basis entirely uneconomic for our farmers. They were promised, however, by the Minister for Agriculture on behalf of the Government a remunerative price and an assured market for all the wheat they would grow in 1933. This promise was implemented by the Agricultural Produce (Cereals) Act, 1933, which greatly altered the outlook of both farmers and millers in regard to the growing of wheat and the production of flour for the country's requirements.

The Cereals Act empowered the Government to fix "standard" prices for home-grown wheat and to enable the price obtained from the miller to be supplemented by a bounty equivalent to the difference between the average price obtained by all the growers in a sale season and a higher "standard" price. In the first sale season, from the beginning of the cereal year (1st August, 1933) to mid-December, the "standard" price was 23/6 per barrel. For the remainder of the cereal year it was increased to 25/- with a view to encouraging growers who were in a position to do so, to hold over their grain until the spring months and so spread the marketing of the crop over as long a period as possible. The result of the standard price arrangement was that, while the average return obtained by growers was 23/6 or 25/- per barrel according to the time of sale, those growers who grew the best wheat and so obtained the highest market price from the millers got more than the "standard" price, while growers of inferior wheat got less. This differentiation provided an inducement to the grower to produce as good a wheat crop as he could. The millers got the wheat at world market prices and it was unnecessary to make any increase in the price of flour, the bounty needed to make wheat-growing a paying proposition to the farmer being provided from general taxation. The actual rate of bounty paid in the first sale season was 7/- per barrel.

To operate the wheat-growing scheme on a bounty basis it was necessary

to establish in each cereal year a register of wheat-growers who would be eligible for bounty in respect of the quantity of wheat sold by each as certified by a miller or other authorised purchaser. There was necessarily a considerable delay in payment of the bounty and a farmer who sold his wheat immediately after harvest could not get paid until the following spring as the average price could not be determined until all the millers' sale certificates had been scrutinised after the end of the sale season. If a grower died in the meantime payment could not be made until his legal representative had been ascertained. Sometimes in such cases, interest in the property passed to several persons and the consent of each had to be obtained before payment could be made to any one of them—usually the son or daughter working the farm. Sometimes, again, the cost of taking out probate or letters of administration to establish legal claim to the bounty amounted to more than the sum payable. It became evident after a couple of years' working of the Act that the bounty system was cumbersome and giving rise to various administrative difficulties. It was decided, therefore, to change the basis of subsidy to the grower by fixing minimum prices on a bushel weight basis which millers were obliged to pay and thus to transfer the cost from the taxpayer to the consumer by increasing the price of flour, and consequently of bread, to a price sufficient to remunerate the miller for his increased outlay on wheat. The millers did not confine themselves to the minimum price but usually paid a premium of about 2/6 per barrel which they were able to do without any corresponding increase in the price of flour. The minimum prices to growers were announced two years in advance so that farmers might arrange to include wheat in their normal rotation of crops.

Until 1933 there was no obligation on millers to purchase home-grown wheat but it became essential to any scheme for extending wheat-growing that growers should have a guaranteed market as well as a satisfactory price. At the same time a miller could not be expected to pay the fixed price for wheat which he could not use, so his obligation was limited to the purchase of millable wheat, defined as wheat commercially clean, in sound and sweet condition and capable, having regard to the methods customarily used in the milling industry for the cleaning and conditioning of wheat, of being milled into flour suitable for human consumption. To ensure a market for all wheat conforming to this description the Cereals Act, 1933, linked provisions for the increased growing of wheat with provisions for the increased home production of flour by the establishment, under the Control of the Minister for Industry and Commerce, of a system of licences for mills. Each licensed mill was allotted a milling quota related to its capacity and the holder of the licence was obliged to mill not less than 90 per cent. of that quota in each cereal year, while, if he exceeded the quota he had to pay to the Minister for Industry and Commerce a severe penalty proportionate to the extent of the overmilling. Millers were thus obliged to keep their mills in regular operation and at the same time undue competition, which might result in the closing down of mills, was eliminated. The total capacity of the mills existing at the

passing of the Act was insufficient to provide flour for full requirements and their output was supplemented by permitting the importation, under licence issued by the Minister for Industry and Commerce, of sufficient flour to make up the deficiency. As the prohibition of imports of flour, except under licence, rendered a protective tariff unnecessary the import duty of 5/- imposed in the previous year was discontinued. That duty had enabled several "silent" mills to resume work and when the Cereals Act became law additional flour mills, equipped on the most modern lines, were quickly established at Carlow, Cork, Milford (Co. Donegal) and Waterford. As these came into operation flour imports were reduced and when all were working, licences for the importation of flour ceased to be issued.

Wheat imports were controlled by licences issued by the Minister for Agriculture to an extent sufficient to supplement home production of wheat. The absorption of the latter by the mills was secured by fixing each year, by Order of the Minister for Agriculture, a "national percentage" applied to the milling quota allotted to each licensed mill. This percentage of his quota the miller was required to mill each year in the form of home-grown wheat and he had, therefore, to set out to purchase home-grown wheat to an extent sufficient to enable him to fulfil his obligation. The national percentage was based on the estimated production of wheat of each year's harvest and was fixed some time before the beginning of the cereal year so that millers could make their arrangements. The figure could be varied later so as to adjust it closely to the actual quantity of wheat marketed and so provide equitable distribution among the millers, none being obliged to purchase or mill more than his quota. The foregoing steps soon affected the wheat area. In 1933 the acreage was 50,000 and in 1934 almost 94,000. In 1935 it stood at 163,000 and the following year it reached 254,000 acres which represented the high-water mark of wheat-growing until 1939.

As the area under wheat increased new problems arose and had to be dealt with. Prior to 1933 flour millers had no occasion to provide storage for more wheat than would meet immediate requirements. The various grain importers supplied them with a steady stream of cargoes at the ports and every miller could secure a fresh stock of wheat at very short notice. If, however, for any reason such as anticipation of a rise in price, a miller wished to build up his wheat stocks, and had storage space available, he could do so safely, the wheat being sufficiently dry to allow of its being stored in bulk for a considerable period. The storage of home-grown wheat was not so simple. Even when harvested under the most favourable conditions its moisture content was so high relatively that it could not safely be stored for any length of time unless artificially dried or alternatively stored in such a way that it could be turned over by manual labour at fairly frequent intervals. When replying to questions put by the Tariff Commission in 1928, the Irish Flour Millers' Association pointed out that they could not finance or safely store, even if they had the accommodation, the entire home wheat crop if growers pressed

it for sale as they do barley, immediately after the harvest. The Association therefore, claimed that it would be impossible for millers to purchase their requirements of home-grown wheat except in the same way as previously, namely, as required.

It soon became evident, however, that the purchase of wheat by the millers on such lines, even with an attractive price and an ultimate assured market would have a disastrous effect on wheat-growing. The majority of farmers, no less than the millers, had no means of holding their wheat in store for any lengthy period after threshing and in the vast majority of cases were financially incapable of providing suitable storage accommodation. Even if they could do so their wheat had a moisture content too high for safe keeping and would not remain sweet unless given attention which they could not afford. It became necessary, therefore, to market the crop when threshed, or cease to grow wheat. The increased standard or minimum price in the period after December was an attempt to induce a proportion of the growers to keep their wheat in the stack and have it threshed in the spring months, but in practice this offered no solution as each year 90 per cent. of the entire crop was threshed and thrown on the market before Christmas. The inability of a mill in a particular area to absorb the farmers' wheat as quickly as offered led to complaints of loss or deterioration of grain, involving financial loss to the owners and a general set-back to wheat-growing in that area.

To meet the situation the original Act was amended by the Agricultural Produce (Cereals) Act, 1935, by which each miller having an annual milling quota in excess of 10,000 barrels was required not only to mill his home-grown wheat quota but also to purchase, dry and store the wheat. An Order made each year by the Minister for Agriculture under the Act prescribes percentages of the quota which each licensed miller must purchase in the period of the cereal year ending 31st October and on each of several succeeding months so as to absorb the crop. Another annual Order requires each miller having a milling quota exceeding 10,000 barrels to provide and reserve sufficient storage accommodation for a specified proportion of his home-grown wheat quota and to provide drying facilities capable of dealing with a specified quantity of wheat per day in proportion to his quota. The rate at which wheat can be delivered to the mills is, to a large extent, regulated by the capacity of the threshing mills operating in the country. In fixing storage and drying requirements regard was had to this, as well as to the existing storage and drying capacity of the mills, or that which they might reasonably be expected to provide either by additional capital expenditure or by renting accommodation from maltsters or others engaged in the business of drying and storing grain. The purchasing, drying and storage regulations have been adjusted from year to year to keep pace with the increasing production of wheat and the accommodation necessary to deal with it.

All but a few of the millers affected by these requirements, realising that

the policy of home production of wheat was one demanding their earnest co-operation, quickly set about installing ample drying and storage facilities at or in connection with their mills instead of depending on rented accommodation. Fortunately there was at that time no difficulty in procuring drying equipment and from very soon after the passing of the Act of 1933 right up to the emergency in 1939 some of the most modern grain-drying plants in the world were erected in this country. One flour mill has a plant capable of taking in the wheat from the growers and drying it down to a safe keeping moisture content by an automatic process at the rate of fifty tons per hour. In another thirty tons per hour can be similarly handled. A number of other installations with capacities of from one ton per hour to fifteen tons per hour are located throughout the country wherever flour mills are situated and are so organised that they work continuously twenty-four hours a day during the peak period of wheat reception. Even during the emergency it has been possible to provide some additional drying plant as well as the storage space which must accompany it, and the heating arrangements for the drying process have been adapted to burn native fuel. The few mills that have not, so far, provided themselves with drying plant of their own are in a position to rent their requirements and thus all of the thirty-seven flour mills in the country are able to purchase the home-grown wheat as quickly as it is offered to them by the growers and to dry and store it in safety until it is required for milling into flour. There is now a reserve of both storage and drying to meet exceptional conditions such as a very wet harvest and the measures taken have placed the country in the position of being able to dry and store in one hundred days, if necessary, the whole wheat crop marketed by the growers.

It had been the custom for the majority of those farmers who grew wheat, to have sufficient for their own domestic requirements milled into wheaten meal in the small grist mills which exist in considerable numbers throughout the country. Provision was made in the Cereals Act for a continuation and expansion of this practice, permits being issued by the Minister for Industry and Commerce which authorise the holders to mill home-grown wheat on commission for growers. These millers were not permitted to purchase, either home-grown or imported wheat, or to sell wheaten meal, but neither were they subject to the regulations in regard to milling quotas, etc., applying to licensed mills. Some of the smaller licensed mills, however, carried on a combined sale and commission business and, as the extension of wheat-growing had in some cases the effect of increasing their commission milling, and correspondingly reducing their sales of wheaten meal, milling of home-grown wheat on commission in such cases was allowed to count towards fulfilment of the obligation to purchase their home-grown wheat quotas.

As a result of what had been done in the preceding seven years by all concerned, the outbreak of the emergency at harvest time in 1939 found this country in a relatively secure position as regards its breadstuff supplies.

The experience of those years had been that though in unfavourable seasons decreased yields might be expected, yet with reasonable care and attention wheat, even when grown on a large scale, could be grown successfully in an inclement season and would yield a crop of reasonably good milling quality. The area under wheat had risen from some 22,000 acres in 1932 to a figure which varied little from 250,000 acres in the four years immediately preceding the emergency. It appeared that this area represented the maximum production likely to be achieved in the conditions then prevailing, unless the minimum or guaranteed price were to be increased to a point which would involve a further increase in the cost of flour and of bread, or alternatively, an increase in taxation to provide a subsidy stabilising the price of flour.

Wheat-growing on this scale called for some 200,000 barrels of seed wheat each season. About half of this quantity was purchased from seedsmen and included both imported seed and seed assembled by purchase from growers; the remainder of the seed used was held over by or exchanged between the growers themselves. Experiments conducted by the Department of Agriculture for some years prior to 1933 had suggested that Queen Wilhelmina, Squarehead's Master and Yeoman were the most promising winter varieties then in use. On the much greater scale on which seed wheat was required from 1933 onwards Queen Wilhelmina and the almost identical variety, Double Stand Up, retained their general popularity as the principal winter sowing varieties; Squarehead's Master proved particularly suitable for certain areas, mainly in the western counties; and a fair quantity of Yeoman, Pajbjerg, Fenland Wonder, Little Joss and several other locally fancied varieties continued to be imported as long as they were available. Imports of seed wheat were controlled by licences issued by the Minister for Agriculture and importers were required to take reasonable steps to secure that the seed they imported was of good quality and of named varieties only. At first, Red Marvel was one of the most popular of the spring varieties, but for various reasons it lost favour and particularly when a new variety, Diamant, became available in sufficient quantity. This, in turn, was to a large extent replaced about the beginning of the emergency by the Swedish variety, Atle, which had in previous years been found very satisfactory. The great bulk of the spring-sown seed during the last few years has in fact been the produce of some 25,000 barrels of Atle seed imported early in the emergency when the opportunity was taken of importing as much of that variety as could be obtained before this country was cut off from external supplies. Other spring varieties favoured in particular localities or to meet special conditions are Kolben, April Bearded and Fylgia.

Imports of commercial seed-wheat increased from about 20,000 barrels in 1933 to 245,000 barrels in 1939, the last year in which importers could freely obtain their full requirements from firms abroad. In the following two years imported supplies were on a greatly reduced scale and practically ceased after 1942. Thenceforth the requisite seed had to be provided from

within the country except for an occasional small quantity of pedigree seed which it was possible to import by special arrangement.

For some years prior to the emergency, foundation stocks of pedigree seed wheat produced at the Albert Agricultural College and in extension plots at the Plant Breeding Station at Ballinacurra had been allocated to selected seedsmen for growing on contract. The seedsmen concerned did not always succeed in securing the whole of the produce but such produce as was received was mainly disposed of for seed in the ordinary way rather than grown again under contract. This procedure naturally failed to produce pedigree seed in quantity and wheat crops generally during the past few seasons contained slight admixtures of two or more varieties. In order to make the best use of the pedigree strains becoming available each season the Minister for Agriculture encouraged the formation by certain members of the seed trade of a Company—Pedigree Seed Growers Ltd.—to which will be allocated in future all pedigree foundation stocks arising each season and which will grow these stocks and the produce thereof under contract with a view to making available each year enough seed of pedigree strain to enable growers or other seedsmen to procure sufficient for their own purposes. As a result of the operations of the Company it is anticipated that up to 50,000 barrels of seed of pedigree strains entirely true to name will be available after the 1945 harvest. The varieties Atle and Pajbjerg will be available in largest quantity. Steps have been taken to produce also pedigree strains of Queen Wilhelmina, Square Head's Master and April Red.

In the meantime seed requirements have been met by stocks assembled each year by a number of seed assemblers under permits issued by the Minister for Agriculture. In the case of spring varieties much of the seed was dried down to an extent sufficient to ensure retention of vitality. The assembly of sufficient stocks was encouraged by a scheme under which the Minister guaranteed selected assemblers against serious loss, the difference between the seed price and the ordinary milling price being partly met by a subsidy in cases where an unsold surplus remained on the hands of the assembler at the end of the sowing season.

In spite of the spread of wheat-growing on a large scale to classes of land which a few years ago would hardly have been regarded as suitable for wheat, and despite the shortage of artificial fertilisers and the difficulty, indicated above, of renewing seed stocks, the yield of wheat has remained remarkably good. While not so high as the average of 20 cwts. per acre or over in the period 1910-1930, when wheat was mainly sown on selected lands only and full advantage was taken of the improved methods of cultivation, use of artificial fertilisers, selected seed, etc., encouraged by the educational schemes of the Department of Agriculture, the yield from 1940 to 1944, inclusive, never fell below 17 cwt. per statute acre. Although the weather during some of these years was by no means favourable the yield was, on the

whole, as good as during the years immediately preceding the emergency, and was much better than the average yield from 1850 to 1870, when comparable areas were sown and gave a yield of only 12 to 13 cwt. to the acre.

If the development of wheat-growing and flour milling briefly outlined in this article had not taken place in the period immediately preceding the events of 1939, the food position of this country, so far as bread is concerned, might have been serious during the emergency. The total quantity of seed wheat which could have been made available for the harvest of 1940, assuming that wheat-growing had remained as it was in 1932, would not have sown as much as 200,000 acres, even if a generation of farmers unaccustomed to wheat-growing could have been induced or compelled to procure and sow that quantity at short notice. Actually, over 300,000 acres of wheat were grown in 1940 and the produce, added to the quantity which it was possible to import, just sufficed to meet requirements until the next harvest which yielded the produce of 463,000 acres grown in 1941. Later in the emergency wheat imports were limited to the quantity which could be carried in this country's own shipping and at one period, to avoid a shortage of bread, home and imported supplies had to be supplemented by a substantial quantity of barley withdrawn from industrial use, while at the same time, following several increases above the normal 70% extraction, the whole of the wheat berry had to be ground into flour giving a brown loaf. In 1942 and 1943 over 500,000 acres were devoted to wheat and the harvests of those years supplied over two million barrels of wheat each year to the flour mills as well as providing the whole of our seed supply and as much wheaten meal, ground at over a thousand grist mills throughout the country, as the growers needed for the use of themselves and their families. The wheat harvest of 1944, from some 642,000 acres, required over half-a-million barrels of seed saved from the previous year and provided the flour mills with two-and-a-quarter million barrels of wheat, equivalent to almost two-thirds of the total flour requirements. It also furnished seed for 666,000 acres grown in 1945.

As the economic limit of wheat production appeared to have been reached prior to 1939 it was not likely that the mere existence of a state of emergency would suffice to bring about any substantial increase in the wheat area, and special steps to procure increased production had to be considered. As early as October, 1939, the Government felt it necessary to impose a measure of compulsory tillage which required one-eighth of the arable land to be cultivated in the year 1940. A gradually increasing requirement was imposed in successive years until in 1944 and again in 1945 the tillage quota amounted to three-eighths of the arable land, with an allowance for lands newly laid down to grass after having been sown with corn crops for several years. To encourage more wheat production during the emergency a campaign of advertising and propaganda in the press, by pictorial posters, cinematograph displays and radio talks was maintained with the aim of having 700,000 acres of wheat grown. By virtue of the Emergency Powers Act, 1939, certain of

the provisions of the Cereals Acts were suspended and instead of minimum prices for wheat of the following year's harvest fixed prices were announced each autumn. The price to the grower for the highest grade of wheat was raised to 41/- per barrel in 1941 and increased from year to year until in 1944 and 1945 it stood at 55/-. In addition, from 1943 onwards, the equivalent of a further 2/6 per barrel was provided by crediting growers with a bonus for the purchase of artificial fertilisers at a reduced price when sufficient supplies become available after the emergency. As the wheat acreage did not, up to 1943, approach the figure regarded as the minimum necessary for security, the Compulsory Tillage Orders for 1944 and 1945 included a requirement to sow a proportion of wheat in the tillage carried out on each holding varying from one-tenth of the total arable area in the best wheat-growing counties to one-twenty-fifth in the least suitable.

The combination of a measure of compulsion with which all might reasonably be expected to comply and an attractive price encouraging wheat-growing in excess of the compulsory quota by farmers in a position to carry it out resulted in an immediate increase from 509,000 acres in 1943 to 642,000 acres in 1944 and 666,000 acres in 1945.

The yield of oats which was obtained from 1851 to about 1900 is recorded as having been from eleven to fifteen hundredweights per statute acre. This was very low, especially when it is remembered that a considerable area under the crop was cultivated intensively with hand labour. During that period very little attention seems to have been given to the selection or improvement of varieties, although it had been observed that a change of seed was very advantageous, especially where the new seed was obtained from Scotland where the Potato variety of oats had rapidly come into favour and had displaced most of the older varieties. The popularity of this variety created a market for Scotch-grown seed oats which continued to exist until quite recently, and would probably still exist in some districts if supplies were available.

A commercial strain of potato oats was extensively grown in Co. Roscommon up to about 1920. While it gave satisfactory results on the light and poor types of soil, its tendency to lodge in the clay soils was a serious drawback. In fact it was not unusual to see acres of this variety lying flat after a rainfall, thus rendering harvesting a laborious and expensive operation as the crop had to be cut with scythes.

The importance of introducing strong-strawed varieties of oats had been long recognised by plant breeders, and indeed they had been working zealously for some time at the production of new and improved varieties by hybridisation and selection. The first great improvement that had been brought about was the introduction of such varieties as Banner, Record, Yielder, Abundance and Victory. Those varieties stood reasonably well and gave a comparatively good yield of grain. From about 1920 onwards great strides were made in the introduction of oat varieties, and it can be mentioned with pride that this country kept abreast of the work done in other countries. The Plant-Breeding Department at the Albert Agricultural College, Glasnevin, achieved remarkable results in the production of new and improved varieties.

Victory 2 was the result of a single plant selection made from a hybrid stock obtained from the Plant-Breeding Station, Svalof, Sweden. It has been an outstanding success and is still one of the most popular varieties in cultivation for the medium types of soil. Glasnevin Sonas was the result of a cross between Banner and Tartary. It gave remarkably good results in its capacity to resist lodging and to produce a good yield of grain. Varieties introduced subsequently proved superior especially in respect of quality of grain and earliness. Among these was Glasnevin Success which was not misnamed. It is another hybrid variety specially suited for growing in late heavy, clay soils. The introduction of Ardri, which was derived from a cross between Victory 2 and Glasnevin Sonas, completely revolutionised

the growing of oats in soils where formerly the crop suffered from lodging. Not alone did it prove to be a good standing variety, but it has also proved to be one of the heaviest yielding varieties of oats in cultivation. The first trial plots that were laid down with this variety in Roscommon gave the remarkable yield of 43 cwts. 1 qr. of grain per statute acre. It was then realised that a new variety of oats had at last been introduced which possessed all the qualities that could be desired, and one that was suitable for growing in the heavy, clay loam soils of Co. Roscommon.

At that time the Department of Agriculture had a Seed Distribution Scheme in operation. Pedigree seed oats was allocated on the recommendation of the Agricultural Instructors in small quantities to individual farmers who in turn gave an undertaking to reserve the produce of the crop for seed and to distribute it amongst local farmers in the following season. The plots were small and the amount of seed available was not distributed to any great extent in the following year so that the primary aim of the scheme was more or less defeated. Owing to the limited amount of Ardri that was available at the time it was realised that an effort should be made to propagate this outstanding variety for general distribution and it was this that prompted the writer to introduce a scheme for the growing of seed oats in County Roscommon.

Up to this period there was not any seed-growing tradition among the farmers of the County except in the growing of Certified Seed Potatoes. It was felt that what had already been done to make this latter scheme such an outstanding success could likewise be achieved in the case of seed oats. At the outset it was realised that the primary aim should be to produce seed of a high standard of quality, and with that object in view attention was focussed on a district which had a reputation for early ripening and the production of good grain. Such a district was to be found in a part of South Roscommon where medium, light, limestone loam soil was general, and where it had been recognised that grain crops ripened early, coloured and filled well. A start was made with a limited number of selected farmers in that area. They were supplied with a quantity of from eight to ten barrels of foundation stock of pure-line pedigree Ardri oats from the Cereal Station at Ballinacurra, Co. Cork. At first, five or six growers were selected to participate in the scheme. These growers were expected to continue producing seed from this pure-line stock for at least three years when they were again supplied with a fresh stock from the Cereal Station. A similar number of growers were selected in each succeeding year, and in that manner contact was maintained with the growers of the second, third and even fourth year crops of pedigree oats. It was estimated that twenty-five to thirty growers could produce over 2,000 barrels of reliable seed each season which would be sufficient to supply portion of the requirements of the county. The scheme worked according to plan and it was luckily in full production at the outbreak

of hostilities in 1939. The Tillage Regulations which were subsequently put into operation required the cultivation of an increased acreage of farm crops, and resulted in a considerably increased demand for seed. The County Roscommon seed-growers were not only in a position to supply the requirements of farmers in Roscommon but they had a surplus which was gladly accepted at a remunerative price to the growers by traders in other counties.

Careless and indifferent growers were not allowed to participate in the scheme as it was realised that such growers could create a bad reputation and nullify the efforts of the more conscientious growers who were determined to make the scheme a success. The extension of the scheme meant that a large quantity of seed gradually became available and a market had to be found for the surplus. A very necessary step then was to provide facilities for cleaning and dressing the produce for seed purposes. Unfortunately war conditions hampered the possibility of introducing any up-to-date cleaning machinery and in the majority of cases the growers had to be content with the results obtained from good hand-winnowers. An elaborate cleaning and dressing plant was installed in a local corn mill but owing to the increased quantity of commercial grain that had to be handled during the emergency years it was impossible to deal with the cleaning and dressing of the pedigree seed at this centre owing to the danger of admixture. The installation of an up-to-date cleaning plant is now engaging the attention of those growers. and it is hoped to erect such machinery at a suitable centre to cater not alone for the seed growers but also for local farmers who might be anxious to retain their own grain for seed.

It has been recognised that a change of seed is very advantageous if judiciously made, otherwise, it may not give any good results. The change does not seem to be successful if made from a poor soil in a late ripening district. The best results are obtained from seed grown on good loam soil where plump, well developed and nicely coloured grain is produced. In the poor, light soils and in late ripening districts deterioration seems to take place more rapidly and a change may then be necessary every three or four years, whereas, in the better soils a change may not be necessary for five or six years. A change of seed actually means a change of soil, environment and climate, and if judiciously made, the crop is enabled to resist the attack of insect pests and fungoid diseases and will give an earlier harvest and a larger yield. New hybrid varieties seem to degenerate more quickly than the older-established varieties, and this accounts for the necessity of a more frequent change of seed in the case of the new varieties.

Heretofore the idea generally prevailed that Scotch imported seed oats was superior to homegrown samples. This idea probably arose because of the attractive samples of imported seed that were offered for sale. This seed was

well coloured, clean, uniform, polished and trimmed with up-to-date cleaning plants, but these seemed to be the only outstanding factors that were really in favour of Scotch seed oats. The germination and utility of the imported varieties were not anything better than the homegrown seed ; in fact it has been found that homegrown seed oats when properly cleaned and dressed is equal to any imported seed.

The selected growers of seed oats have to comply with stipulated conditions laid down by the Department and the Committee of Agriculture. They are as follows :—

1. The crop must be sown in suitable soil with no other variety of oats in the same field.

2. The Agricultural Instructor or any Official of the Department of Agriculture must have access to the crop at any time for the purpose of inspection.

3. The crop must be harvested, stacked and threshed separately. The produce must be cleaned and every effort made to convert it into a suitable seed sample before offering it for sale.

4. Any cultivation operation that is considered necessary by the Agricultural Instructor must be carried out by the grower.

5. If the produce is considered suitable it is to be reserved solely for seed purposes, but if it is unsuitable it cannot be offered for that purpose.

6. The grower to be responsible for the quality and purity of the produce offered for sale.

All selected seed oat growers are advised to treat their seed before sowing with a fungicidal powder dressing to prevent fungoid diseases that might be injurious. The farms of those selected growers are visited regularly during the growing season and where a crop shows an undue amount of impurities, smut, rust or fungoid disease it is rejected for seed purposes. Crops are allowed to ripen fully before cutting, and harvesting is done under the most favourable conditions possible. The stacks intended for seed are well made and secured against weather conditions. The threshing is generally done in the spring. This latter idea prevailed amongst the older generation of farmers, and it still seems to stand the test of time. Grain that is threshed during

October, November and December generally deteriorates more or less during storage no matter how well it is kept under ordinary conditions. This is due to the excess of moisture in home-grown grain which gives rise to heating and the development of mildew. There seems to be no better method of keeping seed-grain than in the stack and the old traditional policy of keeping the stacks intended for seed unthreshed until spring is still recommended. The argument generally put forward against this practice is the amount of damage done by vermin and weather conditions. Farmers can do a good deal to check the damage done by rats and mice by building the seed stacks upon trestles of a few feet high so as to prevent rats and mice from climbing up into the stacks. Stacks that are properly thatched and secured will remain dry and undamaged during the most inclement winter.

During the past two seasons selected growers in the county produced over 3,000 barrels of pedigree Ardri and 1,000 barrels of Potato (Ardee). A considerable amount of the Ardri was distributed among farmers in the county and the surplus was sold to seed-merchants in other counties. All the Potato (Ardee) was purchased by local farmers actually before being threshed. Several individual growers realised up to £350 per annum for seed oats.

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LAYOUT OF FARM BUILDINGS.

By

DONAL F. O'DWYER, B.Arch., M.R.I.A.I.

Logically considered, buildings form a part of the production machinery of industry, and if industrial production is to be efficient its buildings must be as intensively organised as a machine for the fulfilment of their function. This is as literally true in its application to farm production as it is in its application to the manufacture of automobiles.

Well-planned farm buildings are rare in this country. When the Milk and Dairies Act of 1935 came to be implemented it was discovered that comparatively few of the applicants for registration had buildings complying with the not over-exacting requirements of the Act, and although there has been some improvement since in the matter of Dairy Farm buildings the general standard of farm buildings and of farm planning as a whole is much lower in Ireland than in other agricultural countries. Many farmers will tell you that they cannot afford well-planned buildings—that Agriculture in its present state cannot carry the overhead expense that they represent. Mr. Henry Ford or Lord Beaverbrook would tell you that their industries could not survive in twentieth-century competition if they had to operate against the drag of inefficiency imposed by badly planned buildings—they could not fight with blunt weapons. Irish Agriculture must soon meet the keenest competition it has yet experienced, and it cannot hope to conquer if its weapons are blunt.

It is not suggested that all existing inefficiently-planned farm buildings should be demolished and rebuilt. The buildings on most farms are the legacy of a haphazard growth from generation to generation. They have grown as our great cities have grown—by continual addition and occasional demolition without any master plan to guide their development. We have awakened at last to a realisation of the chaos towards which our urban development was heading, but the adoption of a town-planning scheme for the City of Dublin does not involve razing the City to the ground to provide a virgin site for the town-planner's activities. It involves a certain minimum of demolition, but its principal aim is to co-ordinate all future building activity in accordance with a master plan so that the growth of the City may be in the direction of a functionally-planned organic unit.

If such long-term planning were applied to the farm, co-ordinating all

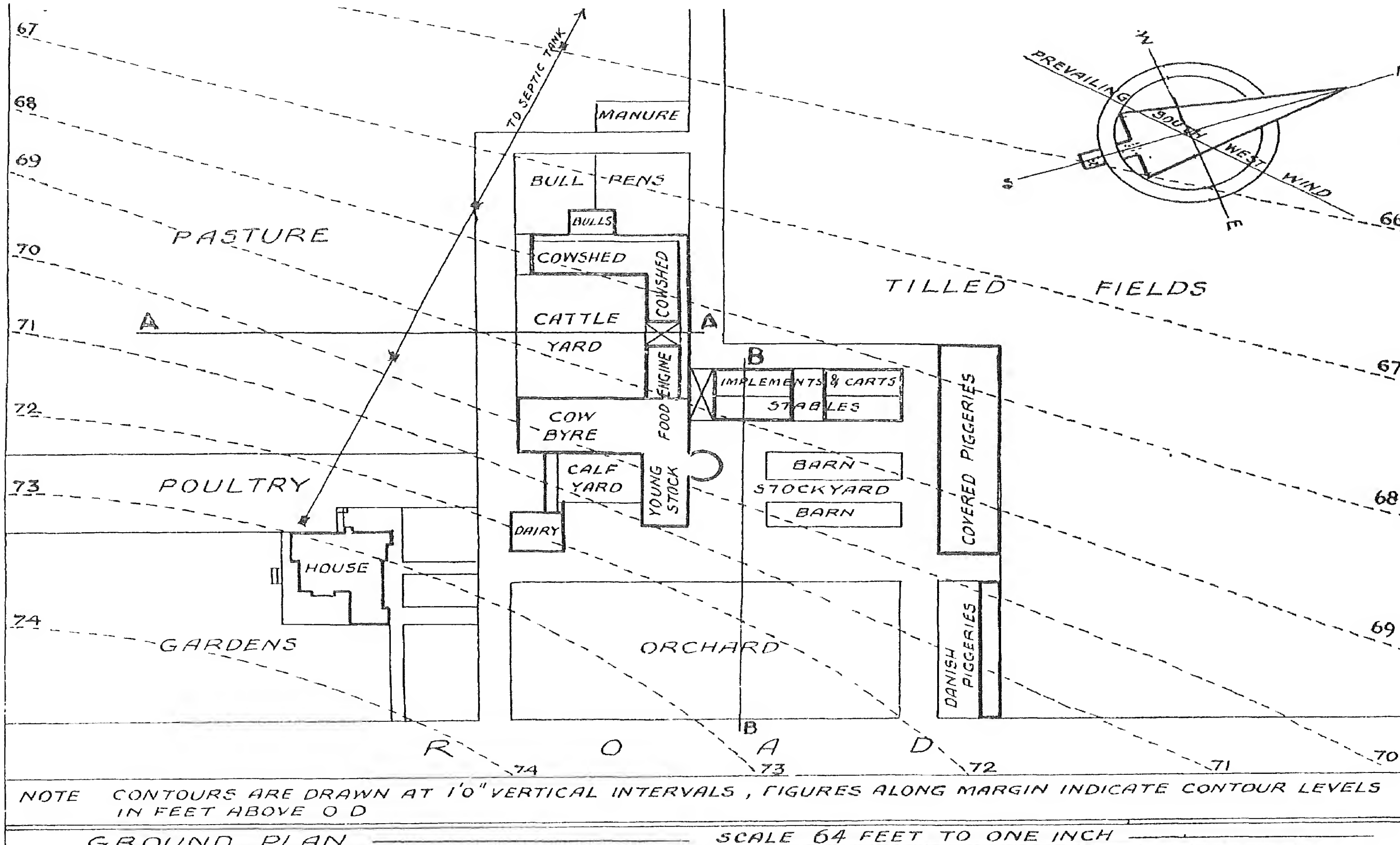
improvement measures in accordance with a single plan, it could transform the poorest holding within the span of a single generation.

Functional planning is but one of a trinity that claims the allegiance of architects. Structure and Aesthetics are the other two, and Structure and Aesthetics bring new gifts to the farm-planner. Structure brings him a wide range of new synthetic building materials and of recently-developed building methods that make it easier to reconcile the conflicting demands of efficiency and economy. They offer a saving in first cost and upkeep which in turn makes possible the provision of better housing standards for livestock and improved storage facilities for crops, fodder and farm implements. Aesthetics gives him a new conception of architectural beauty based on forthright simplicity and sincerity—a conception of beauty that can be realised in an unpretentious group of farm buildings as truly as in a towering Cathedral. Although æsthetics shows no results on the balance sheet it makes a spiritual contribution to that sum total of human happiness which is the final aim that even balance sheets must serve.

Our present aim is to discuss the principles governing the layout of farm buildings—the principles on which the master plan must be based—and we will approach the problem from the viewpoint of functional planning.

In planning a group of farm buildings a wide range of factors must be considered—from the contours of the site to the social habits of pigs; from the direction of prevailing winds to the traffic circulation of animals, fodder, manure, milk and crops. Efficient working of the whole depends as much on the proper layout of the group as on the planning of the individual buildings. The efficient working of each unit depends no less on the skilful planning of the building than on the excellence of its equipment. The planning of each unit is influenced in turn by the type of equipment to be used and the layout of the farm as a whole is influenced by the planning of the individual buildings. With so many interlocking factors conditioning the problem, it is essential to adopt some logical method of approach. In this multiplicity of conditioning factors the problem differs not at all from other problems of functional planning and the method of approach will be the same.

It is a cardinal principle that planning must begin with a study of the site—its size, shape, aspect, contours, prevailing winds, position of existing trees and watercourses and its external approaches. From this study we proceed to sketch the building layout in block-plan form and thence to the planning of the individual buildings. I have not attempted to define the several stages of planning—since this is not a treatise on functional planning—but merely to indicate the order in which the problem must be tackled, beginning with


PASTURE
POULTRY
GARDENS
HOUSE
TO SEPTIC TANK
MANURE
BULL PENS
BULLS
COWSHED
COWSHED
CATTLE YARD
ENGINE
FOOD
COW BYRE
CALF YARD
YOUNG STOCK
DAIRY
IMPLEMENTS & CARTS
STABLES
BARN
STOCKYARD
BARN
ORCHARD
COVERED PIGGERIES
DANISH PIGGERIES
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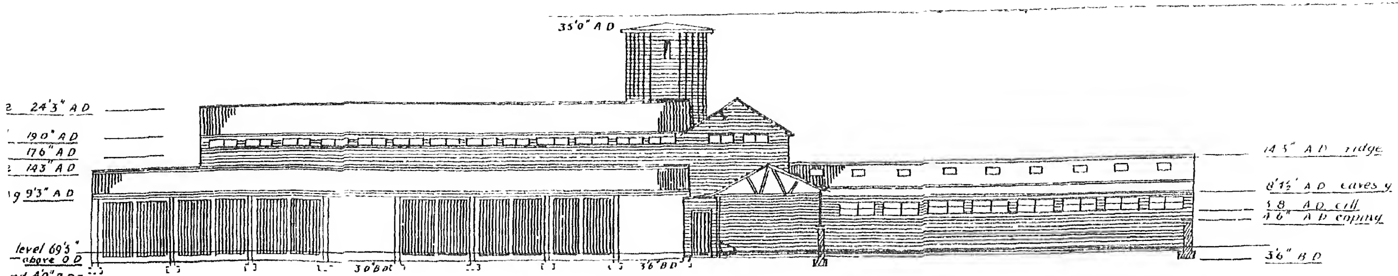
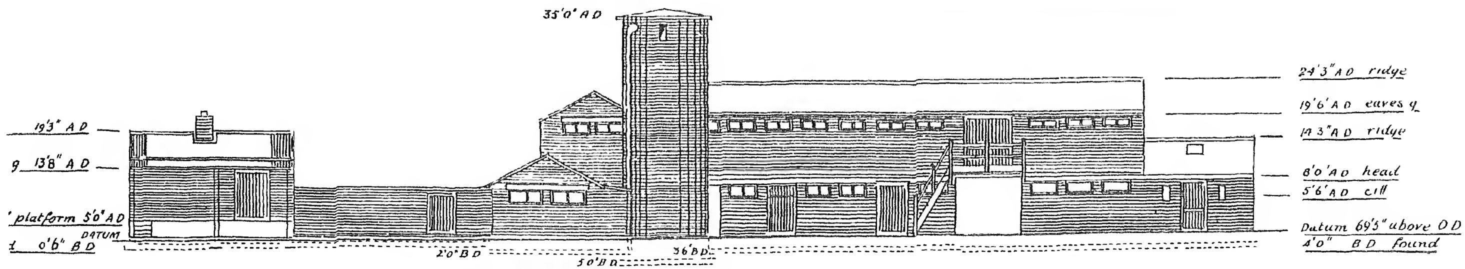
NOTE CONTOURS ARE DRAWN AT 1'0" VERTICAL INTERVALS, FIGURES ALONG MARGIN INDICATE CONTOUR LEVELS IN FEET ABOVE O D
GROUND PLAN — SCALE 64 FEET TO ONE INCH

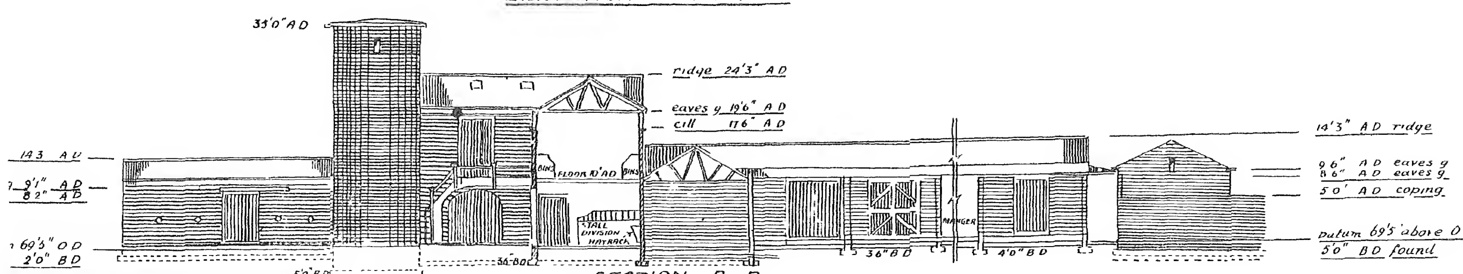
DRAWING No 1



SECTION A~A



ELEVATION FROM EAST



SECTION B~B

DRAWING No 2

the broadest issues and working down through successive stages until the final detail is crystallised.

If this sequence is disregarded—as it is in the case of the haphazard development already referred to—the layout quickly degenerates into a state of functional chaos which checkmates any possibility of logical and ordered growth. The erection of an excellent cow-byre in an ill-considered position may defeat every effort that is expended on the planning and equipment of the building itself and make impossible the economical extension along proper lines of the whole group of farm buildings in the future.

Let us now attempt to formulate in detail those factors that shape the layout of farm buildings and see what specific influence they individually exert. We will apply our analysis to the buildings of a large general farm and thereby cover most of the principles applicable to farms of specialised types.

The drawings, Nos. 1 and 2, show a small-scale layout plan and general working drawings of a group of farm buildings designed to illustrate these principles. Reference to them will help to clarify the analysis that follows.

The buildings and structures required on a large general farm are, at a maximum:

(*a*) Cow-byres.
(*b*) Calf pens and loose pens for cattle.
(*c*) Bull pens and yards.
(*d*) Fattening sheds for dry cattle.
(*e*) Dairy buildings.
(*f*) Stables.
(*g*) Piggeries.
(*h*) Stores for fodder, food and farm produce; silos and food-mixing room.
(*j*) Poultry houses.
(*k*) Manure pit and liquid manure tank.
(*l*) Sheds for carts and implements.
(*m*) Engine, tools and repair house.

The position of the cattle-yard (if a cattle-yard is to be incorporated in the scheme) must also be considered in relation to these elements, and the whole must be planned in proper relation to the farmhouse.

In studying the proper layout of these buildings the following factors must be considered:

(*a*) The site and its contours.

(*b*) The direction of prevailing winds, and cold winds and the shelter afforded by hills and trees.

(*c*) Water supply and drainage.

(*d*) Farm traffic and circulations.

(*e*) Access to main highway.

(*f*) Accommodation, equipment and detailed planning of individual buildings.

(*g*) Orientation of individual buildings.

(*h*) Capital cost (although placed last this is commonly the most urgent consideration).

The Site and its Contours: The ideal farm site would be on fairly high, well-drained ground, with a gentle fall in a suitable direction for drainage outfall, endowed with a spring outcropping on high ground, and provided with the natural protection of hills and trees against cold winds. It would be situated on a good main highway within easy reach of a railway station and market town. Electric power would be available. Such a site is not likely to be encountered, but any of these advantages which the site may possess must be exploited to the full in laying out the buildings and those facilities which are naturally lacking must so far as possible be provided. The position of the farmhouse itself will, if possible, be chosen on high ground, but taking advantage of any available shelter from prevailing or cold winds whilst enjoying full exposure to the sun on the south. Only in special circumstances will it be sited at any great distance from the road.

If the site be sloping or undulating one advantage will, wherever possible, be taken of the more level portions to erect the buildings. If this is not feasible the main lines of the building layout will, subject to overriding considerations of aspect and circulations, be planned to follow the contour lines of the site so as to avoid unnecessary expense in the construction of foundations and rising walls. If it is necessary to provide a water-tank an economy may sometimes be effected by reserving a high portion of the site for the tank and by keeping the buildings at a lower level. An examination of the influence of site contours on the building layout of Drawing No. 1 will help to clarify a number of these points.

The individual site requirements of the several buildings will be dealt with further on.

Prevailing Winds and Cold Winds. The direction of the prevailing wind should obviously influence the layout at least in the following respects:

(i) The farmhouse should be sited to the windward of the main group of farm buildings.

(ii) The dairy should be to the windward of the cow-byres, cattle sheds, farmyard, stables and manure pit.

(iii) The sewage disposal plant should, if possible, be to the leeward of the whole group:

(iv) The farmhouse and stock sheds should be sheltered from the direction of cold winds—a direction which does not as a rule correspond with that of the prevailing wind. In most parts of Ireland the prevailing wind blows from the south-west but the coldest winds are generally those that come from the north or east. This shelter may be naturally provided by the site itself and in siting the buildings advantage may be taken of the shelter afforded by undulating ground or by plantations of trees. The building layout itself may often be shaped to provide the shelter where it is most required.

Water Supply and Drainage. Since most farms are dependent on their own water supply and must provide for their own sewage disposal these two factors must be taken into account at the outset. Rainwater is seldom pure, especially where birds abound. Spring water outcropping at a higher level than the buildings is the ideal supply, but is rare. Most farms are dependent on a well. The well must be sunk in a position where water is available at a reasonable level and once the position of the well is fixed it exerts an influence on the general plan. The farmyard, the manure pit and liquid manure tank (which in turn influence the position of other elements) should be sited at a distance of at least a hundred yards from the well. In relation to the direction of flow of subsoil water they should be downstream from the well so that there is no danger of their draining into it. The sewage disposal system must similarly be well removed and downstream from the source of water. Buildings, yards and roads should be so laid out that ground levels assist the general system of drainage.

Traffic and Circulations. The principal traffic and circulations to be considered are those of animals, food, manure, milk and other farm produce. The buildings must be grouped and sited so that these circulations are convenient and short so that the work of the farm may be efficiently performed with the minimum of labour, and they must be so planned that there is no undesirable crossing of traffic. The cow-byres, for example, must be placed so that the cows have clean and convenient access from the pastures, so that

there is direct communication from the food-mixing room and fodder stores, so that manure can be easily removed and transported to a pit well away from the buildings without crossing the circulations of animals or food and so that a clean and covered approach to the dairy may be provided which will not cross the circulations of animals, food or manure. The place of the other buildings in the scheme of farm circulations will be discussed individually below.

Figure 1 shows a diagrammatic analysis of farm circulations. It is immediately apparent from the diagram that the food preparation room is the hub of the system, taking in supplies from granary, silos, dutch barns and roots store and serving cow-byres, cow and calf pens, fattening sheds, bull pens and stables. It must be understood that the diagram does not attempt to show the individual buildings to scale or to show their relative positions—a plan layout based on the diagram would be quite impracticable—what it does attempt to show diagrammatically is the traffic circulations between any one unit of the complete scheme and the other units. The piggeries and poultry houses are not included in the diagram since they are not intimately bound up with the circulations of the main group. The principles of farm circulations diagrammed in Figure 1 should be studied in their application to the plan of Drawing No. 1.

Access to Main Highway. The road or highway is the extension of the farm circulations to the market. This circulation is not so constantly used as the internal circulations of the farm itself, and so the distance to be travelled from buildings to road will not so directly affect the efficiency of the farm. It is desirable, however, that a good road for lorries should be laid down to connect the main highway with the cattle yard, dairy and the buildings for storing crops. Obviously, the addition of several miles to the length of the journey from farm to market will materially increase the cost of marketing produce but that consideration bears on the selection of the farm site rather than on the layout of the farm on the site.

Accommodation, Equipment and Detailed Planning of Individual Buildings. It would be quite impossible within the limits of this article to discuss the detailed planning and equipment of the individual farm buildings, but the fact that this reacts on the layout of the group has already been stressed. An example of this reaction is given below in the paragraph headed "*Orientation of Buildings*"—the influence of the internal planning of the cow-byre on the most favourable direction of its long axis. And in solving the functional problem of the building layout an alteration in the direction of the long axis of the cow-byre may have repercussions in the stables and the piggeries.

Orientation of Buildings. On the orientation of a building depends the amount of sunshine it receives. A building with windows facing north will enjoy only very oblique sun penetration and that only for short periods in

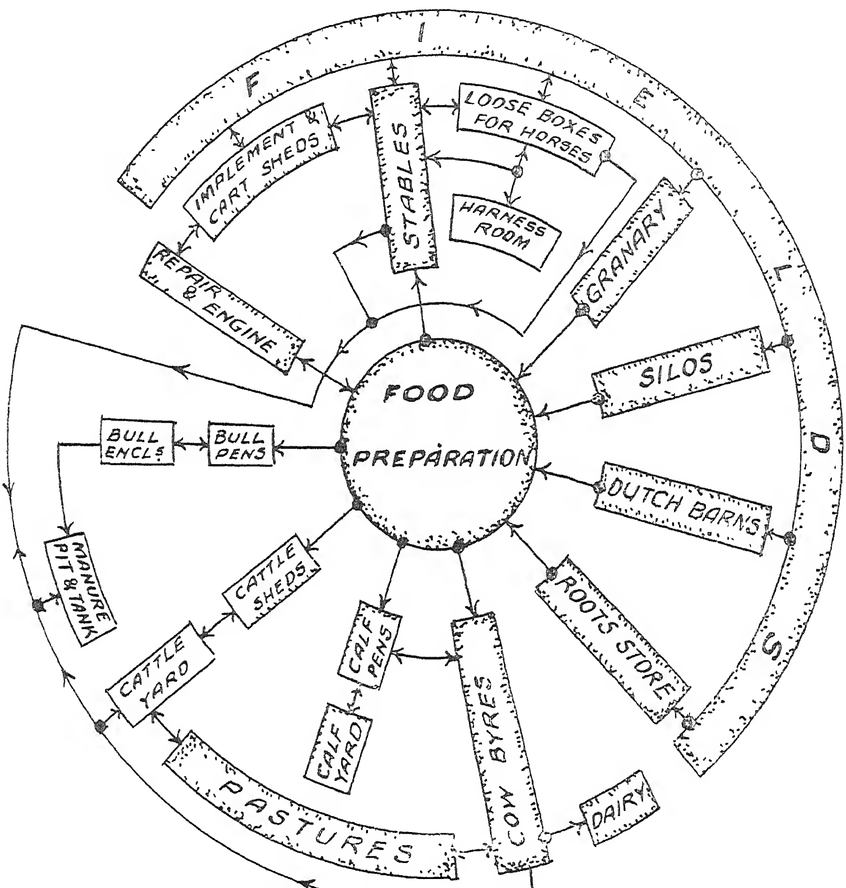
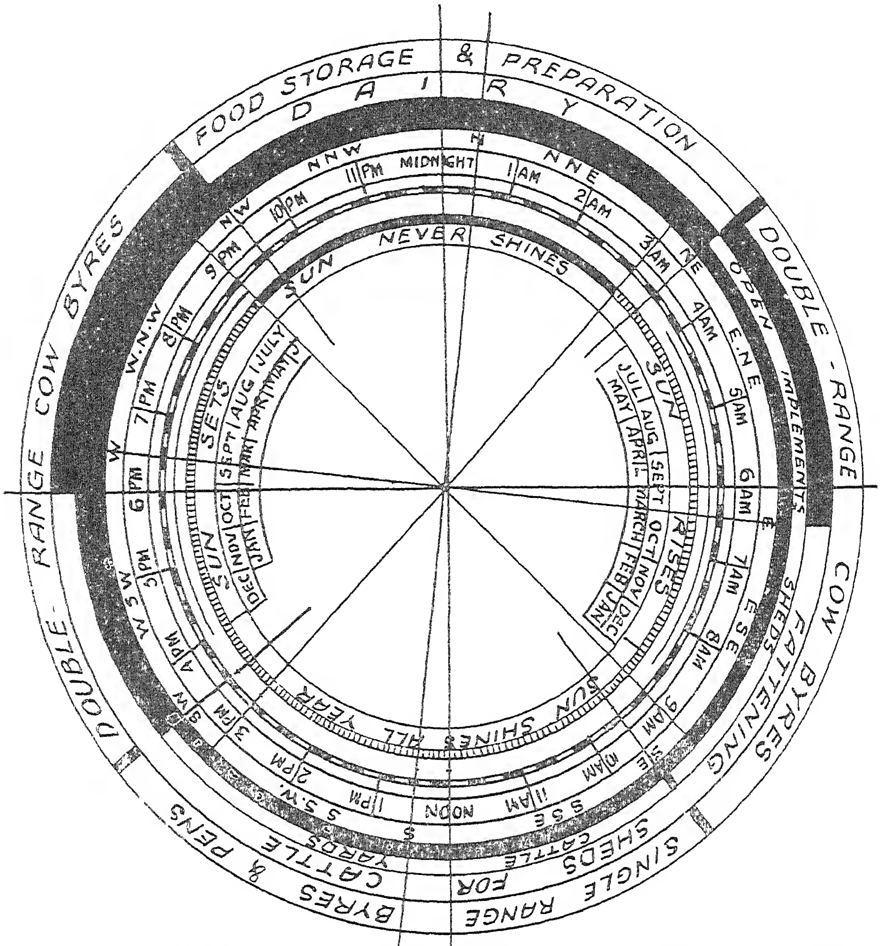


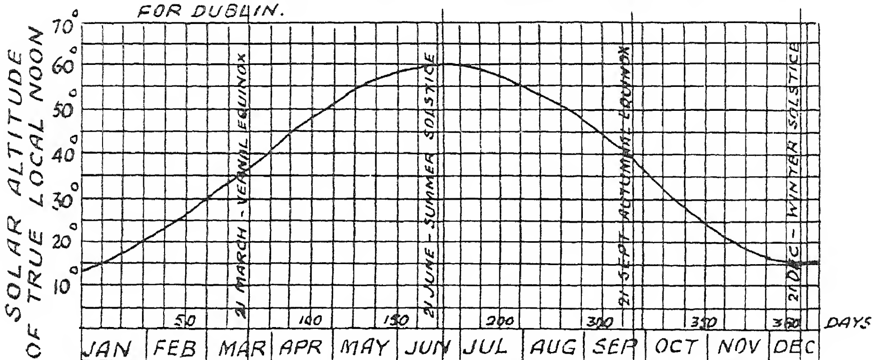
FIGURE ONE

DIAGRAM OF FARM CIRCULATIONS

NOTE : THE DIAGRAM DOES NOT ATTEMPT TO SHOW THE INDIVIDUAL BUILDINGS TO SCALE NOR TO INDICATE THEIR RELATIVE POSITIONS.



INSOLATION DIAGRAM – ASPECTS FOR FARM BUILDINGS
TIMES ARE G.M.T. – TIMES OF SUNRISE & SUNSET CALCULATED FOR DUBLIN.



GRAPH SHOWING ALTITUDE OF SUN AT MIDDAY THROUGHOUT THE YEAR CALCULATED FOR THE LATITUDE OF DUBLIN

FIGURE TWO

early morning and late evening during the summer—for the remainder of the year it will receive no direct sunshine whatever. A building facing east will catch all the morning sun and will enjoy useful sun penetration until about 10 a.m. local time. A south aspect gives the maximum possible penetration over the whole day, and affords fullest penetration at noon when the sun attains its highest altitude and when its radiation consequently suffers least absorption. A west aspect catches the afternoon and evening sun, affording useful penetration from about 2 p.m. until such time as atmospheric absorption of the low-altitude radiation renders the insolation valueless —a time which varies with the seasons.

Figure 2 shows the maximum amount of sunshine to be obtained with different aspects throughout the year. It shows the times of day during which (*a*) the sun shines all the year round ; (*b*) the sun shines only during certain portions of the year in the morning and evening, and (*c*) the sun never shines. It also shows the orientations which will catch the sun at these times. On the outer periphery of the upper diagram are shown the ideal aspects for individual farm buildings. The lower diagram shows the varying altitudes of the sun at midday throughout the year. The lower the altitude the greater is the atmospheric absorption of the solar radiation—hence the lesser value of winter sunshine as compared with that of summer. It will be understood that the sunshine periods shown on the upper diagram are the maximum possible—assuming cloudless skies—and the actual number of hours of sunshine in this country will average only a small percentage of these maxima. Buildings for milk cooling and milk storage require to be kept cool, hence a north aspect is most suitable. Buildings for housing farm animals require sun penetration. This is particularly true of cow-byres where at certain seasons the animals may be housed throughout the day. By special breeding and feeding which has increased the milk yield the dairy cow, naturally a hardy outdoor animal, has developed a susceptibility to tuberculosis which has been increased by housing in dark, damp and unventilated sheds. To counteract this susceptibility fresh air, sunlight and, dry comfortable housing are necessary. The aspect of stock houses and of cow-byres in particular must therefore allow ample solar penetration. This calls for either a north-south or an east-west direction for the long axis of the building, depending on whether a double-range or single-range byre is used.

Capital Cost. Capital cost is a consideration that principally affects the planning and construction of the individual buildings. In so far as it conditions the layout of the buildings as a whole it demands that they should be conveniently grouped to reduce the length of such services as water, electricity, drainage, paths and roadways and mechanical conveyor tracks ; that the buildings should not be erected on steep slopes where the cost of foundations and dead walling is high or on soft ground where foundations must be excessively wide and heavily reinforced, and that where possible the walls of one building should act as one of the supports of another.

The application to the individual buildings of these factors may be summarised as follows :

(a) *Cow-byres* should be sited and planned with a view to cleanliness, warmth and adequate ventilation, to maximum sun penetration, labour-saving feeding and convenient and clean access to the dairy. They should ideally be situated on moderately high well-drained fairly level land, with a slight slope in the direction of drainage. They should be centrally situated with regard to pastures whence they should be reached by a paved approach but not through a manure yard. They should communicate with food-mixing rooms and allow easy extraction of manure to a manure pit on a site removed from and downhill from the byres. They should be near the hay and straw barns. There should be short covered open-air access to the milk receiving room of the dairy—not crossing the path of animals, food or manure. They should be away from any sources of dust or flies and the entrances should not be exposed to cold winds. The side walls and one end wall should preferably be external to allow of good lighting and ventilation and convenient access. The long axis should run north and south in the case of double-range, and east and west in the case of single-range byres. A sufficient supply of clean drinking water and a plentiful supply of washing-down water should be piped to the byres and connection must be made to an efficient drainage system designed to deal with liquid manure and washings. Electric light is a useful service and the provision of food and manure carriers will effect a saving in labour and make a big contribution to cleanliness. The byres must be sited with a view to the economical provision of these services. Reference to Drawing No. 1 will show that a double-range byre is employed to provide standings for thirty-one cows and that the long axis runs approximately north-south whilst single-range stalls for eight young stock have a south aspect. These are the aspects that afford maximum insolation for double and single-range byres, respectively. The feeding passages behind the mangers communicate directly *via* sliding doors, with the food-preparation room and food carriers running on overhead tracks might conveniently traverse these passages. Direct access from the pastures leads to the central passage between the two rows of stalls and a covered way gives communication from the byre to the milk-receiving room of the dairy.

(b) *Calf Pens and Other Loose Pens* should be cut off from the byres but in close proximity to them. They can be conveniently planned under the same roof with the byres with the food-mixing room at the junction. A south aspect is best. Essential services : water and

drainage. Desirable services: hot water, electric light, food and manure carriers.

(c) *Bull Pens and Yards*. The general requirements as regards placement are similar to those for calf pens, but it is generally considered desirable that bulls should be kept out of sight of the cows. Exercise yards should adjoin the pens.

(d) *Sheds for Dry Cattle* should be open on one side, convenient to pastures, food-mixing room and hay barn. They usually have a cattle yard adjoining—in which case the yard should be open on the south. The open side of the shed should preferably face east. Where a large number of animals is to be accommodated the sheds may be planned round the west, north and east sides of the cattle-yard. Sheds are sometimes erected in outlying pastures. Essential services: water and drainage.

(e) *Dairy Buildings* should have an open-air aspect cut-off from cow-byres, but should be conveniently situated to them. They should be away from any source of smells or flies, and should have convenient access to the main highway. They should have a north aspect so that they can be kept cool in summer. It is an advantage to have the dairy at a slightly higher level than the cow-byres, loose pens and stables, so that the large volume of water used in the cooler may be carried by gravity to these buildings and the slightly-warmed water used as drinking water for the animals. Essential services: water and drainage. Desirable service: electric light.

(f) *Stables* should be built on fairly high, dry and sheltered ground. Horses are more vulnerable to draughts than cows. Horses should not come into contact with cows or calves. Stables should be near the cart and implements' sheds, food-mixing room and barns, and there should be easy access from the fields. The aspect is not so important as in the case of cow-byres, but if there is a choice the stables should have south lighting. Stables are usually laid out with a single range of stalls and are consequently comparatively narrow buildings, hence an economy can sometimes be achieved by backing the stables with another building under the same roof, say the cart and implement sheds. Hay lofts are commonly built over the stables. Essential services: water and drainage.

(g) *Piggeries* may be separate from the main group but not distant more than about a hundred feet from it. They can conveniently be planned on the side of the main group remote from the farmhouse. They should be situated on dry well-drained ground (subsoil drainage may often be desirable) and should face south. It is an advantage

to have an exercise yard convenient. A separate food-mixing and boiler-room is provided for the piggeries. Essential services : water and drainage. Desirable services : food and manure carriers.

(h) *Fodder and Food Stores, Silos and Mixing Room.* Hay and straw are stored in dutch barns which should be conveniently planned in relation to the byres, loose pens and stables. They should be situated on a cartway and should have an end facing the prevailing wind. Grain, roots and purchased feeding stuffs, such as cakes and meals are stored in the food store, which is most conveniently situated above the food-mixing room communicating with it *via* a chute. Food storage may sometimes be divided between a granary and a root cellar. It should have easy lorry access for loading food-stuffs. The food-mixing room should be convenient to the dutch barns and should have direct access to the byres, loose pens and stables. It is sometimes necessary to connect chaff cutters and cake mill in the mixing-room by means of shafting to the engine room. Desirable services ; automatic transport from barns to food-mixing rooms ; food carrier from mixing-room to cow-byres, loose pens and piggeries. Silos form part of the food storage group and will be sited conveniently to the food-mixing room. High silos require a cutter and blower which may be operated by shafting from the engine-house or by a tractor.

(j) *Poultry Houses* should be separate from the main group and are generally convenient to the farmhouse. They should be on well-drained porous ground. Electric lighting should be provided if possible.

(k) *The Manure Pit and Liquid Manure Tank* should be placed away from, downhill and downwind from the buildings, and should be accessible from byres, loose pens, stables and piggeries without crossing the circulations of dairy cows, food or milk. The tank will be connected by underground drains with the buildings housing livestock and it is an advantage to run a manure carrier on over-head tracks from the pit to these buildings.

(l) *Sheds for Carts and Implements* should be convenient to the stables and should communicate with the tools and repair shed. They are often built with open fronts but the extra cost of closing in the fronts with sliding doors is generally justified by reduced depreciation of the farm implements. Where the open front is adopted it should face east or north-east. In a very large farm where motor traction is used it may be desirable to house tractor and implements in a central position with respect to the fields, and to

do this it may be necessary to separate these buildings from the main group.

(m) *The Engine House, Tools and Repair Shed* will normally be planned under the same roof with the implement sheds. Shafting from the engine house may sometimes have to be run to the food-mixing room to operate the chaff cutters and cake breakers.

To co-ordinate these factors in a workable layout, to reconcile them when they conflict, and to strike the best workable compromise when they cannot be reconciled is the work of the planner, and obviously no formula can be given for his work.

The very multiplicity of the factors conditioning the layout emphasise the all-importance of the master plan, for it is obviously impossible that haphazard growth could by chance achieve a successful co-ordination of so many factors. One might as well expect the haphazard activities of an amateur fitter with a bag of bolts and assorted castings to produce an efficient automobile.

DOES MEAT AND BONE MEAL CAUSE NUTRITIONAL DISORDERS IN CHICKENS?

By

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Meat and bone meal has for many years been a common ingredient of poultry mashes. It is a convenient method of including at the same time the necessary protein concentrate and the calcium and phosphorous minerals. Where wheat offals form at least half of the total ration the inclusion of 10-12 per cent. of meat and bone meal (40/50 per cent. protein) brings the protein content up to about 16 to 17 per cent. of the ration. Such an amount provides for the protein requirements of growing chickens, particularly in view of the high biological value of meat protein. In recent years, owing to the scarcity of bran and pollard, the carbohydrate portion of the ration has been supplied mostly by oats and barley which contain less protein than wheat offals. Consequently, there has been a tendency to recommend the use of more than the usual 10 to 12 per cent. of meat and bone meal since where bran and pollard are replaced by oats and barley it would require almost 20 per cent. of meat and bone meal to maintain the protein level of the mixture at 16 per cent. to 17 per cent. Feeders' experience with meat and bone meal has varied, some getting very satisfactory results—others experiencing a variety of difficulties in the rearing of chickens. Indeed, many commercial poultry feeders are of the opinion that a high proportion of meat and bone meal is harmful to poultry, particularly to chickens and young growing stock.

During the past four or five seasons, a number of experiments conducted at this College, some specially designed to study the effects of meat and bone meal fed in various proportions and in a number of different food combinations and some conducted for other purposes have yielded results which in conjunction with advances in the science of poultry nutrition made elsewhere throw light on the varying results obtained by poultry feeders from the use of meat and bone meal. They explain also the significance of the appearance of certain disease symptoms among chickens and enable more definite recommendations to be made with regard to poultry feeding. The results and the discussion thereon together with the conclusions are presented in this paper.

Connection has long since been established between feeding and the incidence of certain disorders in chickens. Further investigation into the nutritive requirements of poultry has, however, revealed the function of nutritive factors, the purpose of which had not previously been fully realised.

It is possible, therefore, that disorders diagnosed earlier as being due to certain specific causes may, in fact, be secondary effects which may arise from more than one primary cause.

The chief symptoms of ill-health met with in this investigation were slow growth, ruffled feathers and an unthrifty appearance accompanied in most cases by leg weakness in some form. There was usually a high mortality rate and on examination of the carcases the kidneys showed a pale mottled appearance while the ureters were frequently swollen with urates. The blood of affected chickens, which prior to death frequently developed a condition of coma contained an abnormally high proportion of uric acid. Surviving chickens grew unevenly on the diets which produced the foregoing unsatisfactory results. The more acute cases of disorder were nearly always associated with proportions of meat and bone meal (20 per cent.) which were higher than those usually used. These symptoms are, however, by no means specific. It is well known that even "leg weakness" has many different causes and the mistake of describing most cases of leg defects as "rickets" is now seldom made. This leg disorder may not even be of nutritional origin. Emslie (1) lists the following causes of leg weakness in chickens :—

(i) Infestation by intestinal parasites (Coccidiosis).
(ii) Result of infections such as Leucaemia and "fowl" paralysis.
(iii) Deficiency of vitamin D—rickets.
(iv) Deficiency of calcium.
(v) Perosis (slipped hock).
(vi) Excess of Magnesium.
(vii) Nutritional Paralysis or deficiency of riboflavin (vitamin B_2).
(viii) Deficiency of vitamin B_1—polyneuritis.
(ix) Deficiency of vitamin A.

Under farm conditions any of these causes could be present, although excess of magnesium is unlikely as is also deficiency of vitamin B_1, which vitamin occurs abundantly in cereals and wheat offals.

The literature contains references to the fact that meat meals often give unsatisfactory and erratic results when included in chicken rations. Thus, Ackerson, Blish and Mussehl (2) report that a protein concentrate made up of meat meal alone was inferior to a compound one of meat meal, fish meal and dried butter-milk, the nitrogen content being similar in each case. Christiansen *et al*, (3) found fish meal to be more effective than meat scraps as a supplement to soya bean oil meal in chick rations. They report great variation in the value of different samples of meat scraps. Betke *et al* (4) and Norriss *et al* (5) also refer to the variable results given by meat meal and dried whale meal. A similar variation in results, when meat and bone meal formed the sole source of protein concentrate was a prominent feature of the feeding tests performed during this investigation.

Experimental.

White Wyandotte chicks were used throughout these experiments, the numbers in the individual groups ranging from 25 to 35. They were kept on wire mesh floors and fed dry mash and water. Unless otherwise stated, the experimental mash was not introduced until the end of the first week, up to which time pinhead or flaked oatmeal was the only food given.

The meat and bone meals used throughout the experiment contained 40 to 45 per cent. protein, about 24 per cent. tri-calcic phosphate and 3 per cent. fat. The flesh bone and some internal organs of various types of farm animals were used in its manufacture. The product was well dried and ground to a very fine condition.

The order in which the feeding tests are described in this report is not necessarily the order in which they were carried out. For convenience of reference, similar treatments, or rations which gave similar results are grouped together although the tests may have been done at different periods of time. Throughout the experiments it was found that a variable response was obtained to the feeding of high percentages of meat and bone meal drawn from different consignments and frequently, when in a succeeding season a ration was made up to a formula which had produced a certain degree of disorder in a previous season it was found that the effect was either less marked or more marked than expected. The possible explanations of this variation are discussed later. A considerable amount of repetition of the feeding trials was accordingly necessary. Most of the experiments were planned with a view to elucidating the cause and nature of the nutritional disorders which had previously affected chickens on an all-mash diet compounded in a particular way and containing a high percentage (15 per cent. to 20 per cent.) of meat and bone meal.

Unthriftiness, Leg-Weakness, Nephritis.

In several sets of experiments all the rations shown in Table 1 proved unsatisfactory for chicken-rearing purposes.

Table 1.

	Groups					
	1	2	3	4	5	6
Sussex Ground Oats	40	20	20	20	11½	25
Barley Meal	14	14	48	10	—	—
Maize Meal (Yellow)	28	48	14	47½	16	61½
Potatoes (cooked) ..	—	—	—	—	*ad lib.*	—
Meat and Bone Meal	15	15	15	20	20	10
Salt	½	½	½	½	½	½
Ground Limestone ..	½	½	½	—	—	1
Cod Liver Oil ..	2	2	2	2	2	2

The birds of Groups 1 to 5, inclusive, fared very badly on the above ration. Growth was slow, uneven and irregular and feathering very poor. Leg-weakness, as evidenced by swollen hocks, slipped tendons and curled toes was very common. Mortality ranged from 30 per cent. to 60 per cent. up to the age of thirteen weeks, the deaths occurring mostly between the sixth and tenth weeks. Post-mortem examination disclosed pale and mottled kidneys in practically all cases. The chicks usually developed a condition of coma before death. Uric acid determinations on the blood were performed as a routine test and in the case of those chicks in a coma or obviously near death very high values were found. Very few affected chickens showed less than 10 mgrms. uric acid per 100 ml. blood and many had as much as 20 to 30 mgrms. per 100 ml. blood. Unaffected chicks gave figures of about 6 mgrms. per ml. It became obvious at an early stage that the determination of blood uric acid content was of little diagnostic value as the concentration rose only a short time before the coma condition supervened and when the bird was already obviously near death.

It is well known that pale kidneys having a mottled appearance may indicate a condition of vitamin A deficiency. In these experiments however, 1 per cent. to 2 per cent. of a potent cod liver oil was always included. Moreover the livers of many birds were assayed for vitamin A and in all cases a reserve of the vitamin was found to be present.

Numerous sections were made from the kidneys of affected birds as well as some from normal kidneys for purposes of comparison. Where a "nephritic" condition was obvious on dissection of an affected bird, the histological examination confirmed a condition of gross degeneration of the kidney tissues.

The incidence of leg-weakness and of kidney disorganisation was greater in groups 4 and 5 than in 1, 2 or 3. The chickens in group 6 made subnormal progress and like the birds of groups 1 to 5 showed the unevenness among the members of the group which is characteristic of chickens whose diet is incomplete or unsatisfactory, but the disordered conditions manifested in groups 1 to 5 were largely absent from group 6 where also mortality was low. Obviously the greater proportion of meat and bone meal in the ration the more readily were disordered conditions brought about and this applied to the various types of leg-weakness as well as to the different rate of growth and progress and to the kidney disintegration. The suggestion of a connection between the incidence of "nephritis" and the feeding of a large amount of meat and bone meal was striking in these experiments.

A strange feature of the investigation, however, was that, as mentioned in an earlier section, while the foregoing results were obtainable from certain samples of meat and bone meal, certain other samples failed to give similar results. At no time did a ration compounded according to any of the formula

in Table 1 give satisfactory results with chickens, but, in repeated experiments, groups fed as shown in 1 to 5 in Table 1 did not always fare worse than similar birds fed as indicated in group 6 of the same table. In other words, efforts to reproduce the disordered conditions were not always successful. It will be realised that the various experiments were conducted at different periods of the year and over a number of years so that a large number of consignments of meat and bone meal from the same factory were utilised from time to time.

It will be noted that in the tests recorded above, meat and bone meal was fed in conjunction with ground oats, barley and maize—no wheat offals being used. Another group of tests was accordingly conducted in which wheat offals of pre-war grade were used in part replacement of maize, barley, and oats. Most of the germ was included in the offal. The formulæ of the rations used are shown in Table 2.

TABLE 2.

	Groups				
	7	8	9	10	11
Sussex Ground Oats ..	—	—	—	20	—
Bran	—	—	26	10	28
Pollard	40	50	26	20	28
Barley Meal	15	11½	27½	—	14
Maize Meal	26	16	—	27½	14
Meat and Bone Meal ..	16	20	18	20	12½
Salt	½	½	½	½	½
Ground Limestone	½	—	—	—	1
Cod Liver Oil	2	2	2	2	2

In the case of all these mixtures, *i.e.*, groups 7 to 11, inclusive, there was a very decided improvement in the health and appearance of the chickens as compared with those of groups 1 to 6. Mortality was reduced to about 20 per cent. to 30 per cent. of the numbers in each group. The curled toe type of leg weakness was much less in evidence. The progress of the birds, especially those in groups 7, 8, 9 and 10, was, however, still not satisfactory and cases of swollen and slipped hock joints were common. The birds which died showed on dissection pale kidneys in nearly all cases and swollen ureters, filled with white urates, were frequently noticed. The most satisfactory progress was made by the chicks of group 2, in which case mortality was only 10 per cent. and the birds reached a weight of 3 lb. at thirteen weeks, which though a reasonably good average, falls short of results obtainable from the best type of diet.

The results suggested, among other things, that wheat offals supplied something deficient in the earlier rations and that amounts of meat and

bone meal higher than 12 per cent. were harmful. Riboflavin, a constituent of the vitamin B complex and a factor shown by American workers (4), (5), (6), (7), (8), to be essential to chick nutrition was presumably very seriously deficient in the rations set out in Table 1, and only inadequately supplied in those of Table 2. It was decided, therefore, to add potent natural sources of the vitamin B complex to the type of rations under investigation. That is to say the combination of meat and bone meal and ground cereals used in the tests set out in Table 1 was compared with diets supplemented by other foods rich in riboflavin.

The series of tests set out in Table 3 were accordingly conducted.

TABLE 3.

	Groups						
	12	13	14	15	16	17	18
Sussex Ground Oats ..	15	20	—	22½	22½	17½	22½
Maize	40	47½	57	—	—	—	—
Barley Meal	10	—	10½	50	50	50	50
Meat and Bone Meal ..	20	20	25	20	20	20	20
Sep. Milk Powder	—	—	—	—	—	—	5
Dried Yeast	—	—	—	—	5	—	—
Grass Meal	—	—	—	—	—	10	—
Fresh Grass Clippings ..	—	*ad lib.*	—	—	—	—	—
Fresh Pork Liver	—	—	5*	—	—	—	—
Dried Liver Meal	—	—	—	2	—	—	—
Alfalfa Meal	12½	—	—	—	—	—	—
Salt	½	½	½	½	½	½	½
Cod Liver Oil	2	2	2	2	2	2	2

*5% on dry matter basis: the liver was fed fresh.

As was to be anticipated, in these groups there was almost a complete absence of leg-weakness other than that due to swollen or slipped hock. Some cases of curled toes showed in group 12, but the alfalfa meal used for this group was subsequently found to be of inferior quality and to consist chiefly of alfalfa stem meal rather than alfalfa leaf meal. The progress of the chicks in groups 12 to 18, inclusive, still left much to be desired. Swollen joints and occasional slipped hocks occurred. Mortality ranged only from 10 per cent. to 15 per cent. however, but on dissection of the chickens which had died naturally, a condition of "nephritis" (pale kidneys) was observed in nearly all cases.

It was suspected that the disorders occurring in groups 12 to 18 were connected either with the high protein content of the ration, or with the high calcium phosphate content. The latter usually lay between 4 per cent and 6 per cent. of the entire diet and was supplied chiefly from the calcium

phosphate of the bone included in the meat and bone meal. A number of feeding tests was accordingly conducted in which the protein content of the ration was maintained at a high figure but in which the complication of excessive calcium phosphate from bone meal was avoided. The sources of protein used were meat meal, (without added bone meal), liver meal, yeast, soya bean meal, milk powder. The formulæ of the rations are set out in Table 4. Except in the case of group 26 an amount of each was taken which would supply approximately as much protein as 20 per cent. meat and bone meal had supplied in the earlier rations.

TABLE 4.

	Groups							
	19	20	21	22	23	24	25	26
Bran	10	—	—	28	10	—	—	—
Pollard	—	—	—	27	40	—	—	—
Sussex Gr. Oats ..	20	20	20	—	—	20	20	20
Maize	37	45	44	14	34	50	30	49
Barley	10	10	18	13	—	12	18½	20
Meat Meal (Containing 70 per cent. protein) ..	—	—	15	—	—	—	—	8
Liver Meal	—	—	—	15	—	15	—	—
Dried Yeast	20	—	—	—	—	—	—	—
Sep. Milk Powder ..	—	—	—	—	—	—	30	—
Soya Bean Meal	—	22	—	—	—	—	—	—
Blood Meal	—	—	—	—	13	—	—	—
Salt	½	½	½	½	½	½	½	½
Ground Limestone ..	1½	1½	1½	1½	1½	1½	—	1½
Cod Liver Oil	1	1	1	1	1	1	1	1

Groups 25 (milk powder) 22 and 24 (liver meal) and 19 (dried yeast), gave remarkably good results. In these 4 groups, mortality was negligible, the chicks grew evenly, were well feathered, and the average weights of the groups (pullets and cockerels) exceeded 3 lb. at twelve weeks. The blood meal group—23—did reasonably well, though in other tests a different consignment of blood meal in a ration similarly compounded did not prove satisfactory. The bran and pollard included in the food formula for group 23 doubtless supplied some riboflavin.

The soya bean meal-group did not make very satisfactory progress, although there was little mortality and the birds grew evenly. At twelve weeks they had not passed an average weight of 2½ lb. (pullets and cockerels). The diet of this group, it will be noted, contained no bran or pollard.

Groups 21 and 26 fared badly. Mortality was not abnormal, but at six to seven weeks of age quite a few showed leg-weakness and many, particularly in group 21, had curled toes though there was an entire absence of swollen

or slipped hocks. The results obtained from groups 19 to 26 suggested that in the earlier experiments where 20 per cent. of meat and bone meal was fed, the leg-weakness and "nephritis" produced were not caused by the protein *per se* but were connected rather with the high intake of calcium phosphate and with a deficiency of riboflavin in the diet.

At this stage of the experiment it became possible to obtain supplies of synthetic riboflavin. The following tests were accordingly arranged with a view to demonstrating the beneficial effect which it was anticipated, an adequate supply of riboflavin would produce when added to a diet deficient in this factor.

The ration chosen was as follows:—

TABLE 5.

	Groups 27 *and* 28
Barley Meal	31
Sussex Ground Oats	30
Maize Meal	20
Meat Meal (70 per cent. protein) without bone meal	15
Salt	½
Ground Limestone	1½
Cod Liver Oil	2

Each group was fed on the above basal ration. In the case of group 28, synthetic riboflavin was added to the drinking water at the rate of approximately 500 micrograms per 100 grm. of food consumed. Such an amount provides amply for the riboflavin requirements of young chicks. The results were very conclusive. Practically all the chicks on the basal ration showed leg-weakness at about six weeks of age, curled toes being very common. Mortality was not high, but many cases of "nephritis" as indicated by pale and swollen kidneys were noticed in birds killed for examination and, of course, the birds made slow growth and poor progress. There was no case of leg-weakness or curled toe in the riboflavin group and among ten birds killed for examination at the conclusion of the experiment, only two cases which were even suggestive of mild "nephritis" were observed. The results of this experiment made it obvious that a deficiency of riboflavin was one factor responsible for the unthriftiness, leg-weakness and "nephritis" which occurred in earlier experiments. Notwithstanding the absence of obvious disorders the chicks in group 28 did not, however, make very satisfactory progress. The average weight of the chickens in groups 27 and 28 were as follows (pullets and cockerels):—

	Group 27 (*Basal*)	*Group* 28 (*Basal and riboflavin*)
Age 6 weeks	8.5 ozs.	12.7 ozs.
Age 8 weeks	16.1 ozs.	20.6 ozs.

The riboflavin group, although so much better than the basal group, compared very unfavourably with those of earlier experiments in which milk powder and liver meal formed the source of protein and riboflavin. There can be little doubt that milk, liver, yeast and grass supplied in addition to riboflavin certain essential dietary factors in which the meat meal was deficient.

Perosis or Slipped Hock.

While the incidence of the curled toe type of leg-weakness in chickens fed on rations made up of oats, barley, maize, meat and bone meal, salt and cod liver oil is caused by shortage of riboflavin in the diet, the occurrence of leg-weakness of the type with which slipped or swollen hock is associated in chickens fed on the same mixture of foods but in which the proportion of meat and bone meal was excessive could have been due to excessive intake of calcium phosphate. Further tests on the occurrence of slipped hock (*perosis*) were accordingly arranged and Table 6 gives the formulæ of the rations used :

Table 6.

	Groups 29	30	31	32
Bran	20	—	—	—
Pollard	32	—	—	—
Sussex Gr. Oats	—	20	20	20
Maize	16	48	48	48
Barley	16	10	10	—
Meat and bone meal	14	20	20	—
Milk Powder	—	—	—	30
Whey	*ad. lib.*	—	*ad. lib.*	—
Salt	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Cod Liver Oil	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$

The incidence of "Perosis" in the above four groups was as follows :—

Group 29	a few cases.
Group 30	$\frac{1}{3}$ of chickens affected.
Group 31	$\frac{3}{4}$,, ,,
Group 32	No chicken ,,

In the case of group 30 the chickens made very slow progress. The group was uneven and there was definite evidence of leg-weakness of the curled toe type as well as cases of slipped hock. In groups 29 and 31 on the other hand to which the whey supplied abundance of riboflavin while curled toe paralysis did not manifest itself perosis developed.

In these two groups the chickens made very good growth, and continued to progress even after the onset of the slipped hock condition which made its appearance for the first time in the fifth week. Towards the end of the twelve-week experimental feeding period some of the birds could get to the feeding trough only with difficulty and consequently made slower progress. The birds in group 32 thrived in a remarkable manner. There was no mortality and no suggestion whatever of leg-weakness or other disorder. The average weight (cockerels and pullets) at twelve weeks of age was 3.1 lb. The results from groups 29 to 32, coupled with those from earlier tests, show that perosis is a disorder, the onset of which is associated with excess of calcium phosphate in the diet. It was concluded that the high calcium phosphate intake was a second factor in the causation of unthriftiness, leg-weakness and "nephritis" in the earlier experiments in which chickens were fed on rations containing more than 15 per cent. of meat and bone meal.

Decomposed Meat Meal.

As already mentioned, it was noticed throughout this series of experiments that it was not easy to reproduce the disordered conditions with any degree of certainty. In this connection it was thought that the quality of the meat and bone meal, in view of the unusually large quantities consumed, might be a disturbing factor. To obtain information on this point a quantity of meat meal (without bone meal) containing 70 per cent. protein was brought to a state of decomposition by keeping it for a period of one week in a moist state at about 37°C. After a few days a very vigorous evolution of gas, and a particularly foul odour developed. The mass was then air-dried and amounts corresponding to 20 per cent. of dried meal were included in rations, as follows :—

Table 7.

	Group 33	*Group* 34
Bran	10	10
Pollard	30	30
Maize	40	40
Meat Meal	16	—
Meat Meal (decomposed)	—	16
Ground Limestone	1½	1½
Salt	½	½
Cod Liver Oil	2	2

There was no discernible difference in the progress of the two groups. Growth was poor in both cases, due, no doubt, largely to deficiency of riboflavin, average weight at twelve weeks being only 2½ lb. Mortality in each group was in the region of 20 per cent. It had been anticipated that 16 per cent. of such obviously putrid material would be very deleterious and in view of the many well-founded cases of damage being caused by decomposed food

the result is surprising. Confirmation of the above result was obtained later when similarly decomposed meat meal was fed over a period of three months to a group of laying pullets—a comparable group being fed on an equivalent amount of good quality meat meal. Again, there was no difference between these groups, both of which continued in good health and layed normally.

Horse Flesh and Ox Flesh Meat Meal.

Both the meat meal and the meat and bone meal used hitherto were of the ordinary commercial type. At this stage, an opportunity occurred of comparing meat meal made from ox-flesh with that made from horse-flesh. Accordingly, two groups of chickens were fed on rations made up to the following formulæ :—

Table 8.

	Group 35	*Group* 36
Bran	10	10
Pollard	50	50
Maize	20	20
Horse Meat Meal (70 per cent. protein) ..	16	—
Ox Meat Meal (70 per cent. protein) ..	—	16
Salt	$\frac{1}{2}$	$\frac{1}{2}$
Ground Limestone	$1\frac{1}{2}$	$1\frac{1}{2}$
Cod Liver Oil	2	2

In case of group 35, meat meal had been manufactured specially for the purpose of this experiment from horse flesh and in group 36 ox-flesh only had been used. Both groups made fairly satisfactory progress, average weight at twelve weeks being $2\frac{3}{4}$ lb. As was expected in view of a possible deficiency of riboflavin slight symptoms of curled toe paralysis and "nephritis" occurred in each group. However, there was no difference noticeable between the two groups. This result was also unexpected, as there are references in the literature to a gouty condition in fowl developing as a result of the consumption of considerable quantities of horse-flesh.

DISCUSSION.

The results indicate in the first place that the rations used in Table 1 were deficient in certain vitamins of the B complex, notably riboflavin (vitamin B_2). This vitamin occurs abundantly in liver, dried brewers' yeast, and milk, including separated milk and whey. Grass, good quality grass meal, and alfalfa leaf meal provide fair amounts of it. Grains contain only small amounts, but offals, particularly wheat offals, are richer sources than the whole grain and since they often form a very large proportion of the poultry ration they may provide a substantial proportion of the chicks' requirements for riboflavin. Meat meals and meat and bone meals contain small and variable

amounts of riboflavin. The variable results given by meat meal and meat and bone meals when included in chicken rations are no doubt partly explained by the varying content of this vitamin. If a sample contains a moderate amount and if in addition there is a considerable proportion of bran and pollard in the ration, a sufficiency of this vitamin will probably be provided. On the other hand, a sample of meat and bone meal low in riboflavin, particularly if fed in conjunction with a predominantly maize, oats and barley mixture, will lead to signs of deficiency manifested by slow growth, curled toe paralysis or leg-weakness and uneven development among the chicks of a group.

It is not surprising that meat meals should vary in their riboflavin content. Since livers are a relatively potent source containing many times as much riboflavin per unit weight as the flesh, the inclusion or exclusion of the liver of the animal when the carcase is being converted into meat meal will considerably affect the riboflavin content of the product. Moreover, the livers of some animals are richer in it than those of other animals. A further consideration is the fact that although riboflavin is more stable to heat than many other vitamins, nevertheless, the steaming and heating during the process of manufacturing meat and bone meal will reduce its riboflavin potency in varying degrees.

A study of the formulæ of Table 1 in the light of the above considerations will show that there is no potent source of riboflavin included. As stated earlier, this resulted in the onset of the characteristic curled toe type of paralysis. In some of the groups, particularly in groups 4 and 5, swollen hocks and slipped tendon were also in evidence. Although none of these symptoms appeared in group 6, nevertheless the chickens did not thrive or make good weight gains. Apart from other defects of the diet, possibly the percentage of protein was too low for maximum growth. A deficiency of riboflavin was, however, a determining factor in the case of group 6 as well as in the first five groups. The fact that there was practically no sign of the curled toe paralysis in group 6 (10 per cent. meat and bone meal) while it appeared in the other five groups (15 per cent. to 20 per cent. meat and bone meal) is an example of one of the strangest features of these feeding trials. The observation that reducing the amount of meat and bone meal lessened the incidence of curled toe paralysis was confirmed in several subsequent experiments. One such confirmatory test is given in Table 4 where the incidence of curled toes in group 21 getting 15 per cent. of meat meal was greater than in group 26 getting 8 per cent. meat meal. Since riboflavin was deficient in the high protein groups, signs of curled toe paralysis and possibly "nephritis" might have been expected in the low protein groups also, where presumably the riboflavin content was still less. In fact if the meat and bone meal was supplying an appreciable fraction of the total riboflavin supplied in these rations the amount of it in the low protein groups would be less than in the high protein groups. The absence of pronounced symptoms of deficiency in the groups fed

on diets relatively low in meat and bone meal would suggest that the higher the protein content of the ration, the more riboflavin was required. Possibly the 15 per cent. and 20 per cent. of meat meal or meat and bone meal provided a stimulus to growth which demanded increased quantities of riboflavin, and in its absence the grosser signs of deficiency appeared.

It cannot be claimed that there is conclusive proof in this paper of such an interrelation between the protein level of the diet and the riboflavin requirements. The evidence from the literature on this matter is also inconclusive. Prunty and Roscoe (9) say that in the case of rats there is no evidence that a high protein diet needs vitamin B_2 to balance it. On the other hand, Lure and Ford (10) state that the fact that the nitrogen retention of rats on riboflavin-deficient diets is less than that of pair fed controls shows that riboflavin is concerned with protein metabolism. Another interesting observation in this connection is that of Norriss *et al* (7) who found that the addition of small amounts of riboflavin increased the severity of curled toe paralysis whereas larger amounts completely prevented it. Stockstad and Manning (11) report that when an unsupplemented basal ration was fed, very few cases of paralysis occurred, whereas the addition to it of sub-optimal amounts of riboflavin produced many cases. The authors mention that rate of growth may accentuate the occurrence of these deficiency symptoms. It is possible, therefore, that similar considerations explain the absence of marked signs of this type of leg disorder in group 6, Table 1 and in group 26, Table 4, whereas other groups presumably supplying at least as much and possibly slightly more riboflavin showed many cases of the deficiency.

The significance of these observations to the practical feeder is that in circumstances where chickens are being fed on a high plane of nutrition and consequently expected to make the most rapid progress it is most important to secure that their riboflavin requirements as well as their requirements for other nutritive factors are amply provided for. It is of interest to record the findings of Cunha *et al* (12) that the addition of certain vitamins without others to a diet of natural feeding-stuffs seemed detrimental to growth Cravens *et al* (13) commenting on this observation, report that unpublished data of their own obtained from experiments with breeding hens seemed to confirm it.

The rations shown in Table 2 differ from those of Table 1, chiefly in the use of wheat offals in part replacement of maize, barley and Sussex ground oats. The lessened incidence of curled toe paralysis would suggest that appreciable quantities of riboflavin were supplied. That the amount was far from adequate was shown by the incidence of some cases of curled toes. The uneven growth, mortality and unthriftiness of the group were no doubt also connected with the prevalence of perosis and possibly deficiencies of other vitamins of the B complex.

The results obtained from the feeding of the rations in Table 3 confirm that the rations shown in Tables 1 and 2 were deficient in riboflavin. The supplements listed in Table 3 which are potent sources of riboflavin are milk powder, whey, dried yeast and liver. Grass meal and clippings provide large amounts, and so also does alfalfa leaf meal of good quality. The leg disorders which occurred in the groups of Table 3 were due to the perosis-producing tendency of the high calcium phosphate content of the ration consequent on the use of high percentage of meat and bone meal.

The formulæ shown in Table 4 were designed to supply large amounts of protein while keeping the percentages of calcium and phosphorous within normal limits. The meat meal was specially prepared for this test and by removing the greater part of the bone meal usually included, a protein content of 70 per cent. resulted. The remarkable rate of growth and freedom from mortality and disorders exhibited by the groups on liver meal, milk powder and dried yeast was to be expected. These rations were complete and balanced. The three supplements just named provided ample amounts of riboflavin and other vitamins of the B group. The cod liver oil supplied vitamins A and D. The calcium and phosphorous requirements were adequately provided for by the ground limestone. The proteins were of high biological value and more than sufficient in amount. There was a definite deficiency of riboflavin in the diet of the meat meal groups—21 and 26—the birds in which made poor growth and developed the curled toe type of leg-weakness. Unlike similar groups in other experiments, but in which the source of protein was meat and bone meal, these meat-meal-fed chickens, however, showed no signs whatsoever of leg-weakness of the slipped hock (*perosis*) type. The bloodmeal group, although fairly satisfactory, fell short of the performance of the liver, milk and yeast groups. The ration in which it was included was probably deficient in riboflavin. Similar considerations apply to the group getting soya bean meal as a protein supplement. There are many references to the fact that soya bean meal is unsatisfactory as a sole source of protein. Thus Hammond and Titus (14) found that when using soya bean meal as a protein concentrate, the ration was improved when wheat was added to a maize-oats mixture as the cereal part of the diet.

Norriss and Heuser (15) report that loss of weight occurred in pullets with soya bean meal as the sole source of protein. Carver *et al* (16) state that soya bean meal was unsatisfactory, particularly at higher levels, and found that combinations of fish meal, meat scraps and soya bean were improved by the addition of skimmed milk which had the effect of accelerating rate of growth and preventing nutritional paralysis. It would appear that the results given by soya bean meal are capable of the same interpretation as the results given by meat meal in our experiments, namely that provided all known nutritive factors are present high percentages of meat meal may be fed with impunity.

The results of feeding the ration shown in Table 5 in which as in the previous group of tests, the complication of excess of calcium phosphate was eliminated by feeding meat meal instead of meat and bone meal, and which ration was supplemented in the case of one group with synthetic riboflavin proved quite conclusively that riboflavin had been the chief deficiency in all earlier tests in which the diet consisted of a mixture of, meat and bone meal, barley, oats, maize, salt and cod liver oil. As shown by the weight records a very striking difference between the control group and the riboflavin group was evident. That food factors, other than those supplied to group 28, are involved in optimum growth is, however, shown by comparing the progress of the chicks in group 28 with those of groups 19, 22, 24 and 25 of Table 4. The liver, milk and yeast used in these earlier groups presumably supplied other vitamins of the B group because of which the chickens made that remarkable growth and progress already referred to.

The condition of swollen or slipped hock was much in evidence in the case of all groups of chickens fed a diet high in meat and bone meal. Table 6 shows that the perosis or slipped hock condition was most pronounced in the groups included in that table which contained the greatest amount of calcium phosphate (group 31—20 per cent. meat and bone meal with whey *ad lib.*). Since no water was provided in either group 29 or group 31, the chicks consumed very large quantities of whey. As expected, the condition was not so marked in group 29, (14 per cent. meat and bone meal with whey *ad lib.*) as in group 31, since the ration contained less total calcium phosphate, a high proportion of which must be present before this type of leg disorder appears. The other factors known to be concerned in the production of perosis are a deficiency of manganese and of certain vitamins of the B complex. The causes and prevention of perosis are not yet fully elucidated. The simplest way in which the practical feeder may prevent the onset of the disorder is by refraining from feeding excessive amounts of calcium and phosphorous. It is not easy, in the present state of knowledge, however, to fix a safe upper limit. Herner and Robinson (17) had no difficulty in producing perosis by adding supplements of meat meal ash to a basal ration which already included 16 per cent. meat meal. The percentage of calcium in the complete ration used by them ranged from 1.4 to 2.1 and the phosphorus from .86 to 1.22. In the unsupplemented basal ration 9.5 per cent. of the chicks showed symptoms of perosis and in the highest calcium phosphate group 70 per cent. were affected. The higher limit of calcium and phosphorus mentioned in the experiments of Herner and Robinson would be reached by including 20 per cent. of the sample of meat and bone meal used in our experiments, and only 13 per cent. would be required to provide the amount of calcium and phosphorus in their perosis-producing basal ration. From such considerations, and from an examination of the results shown in Table 6 it may be concluded that where no other source of calcium phosphate is included, meat and bone meal (analysing about 25 per cent. phosphate of lime) may form up to 10 per cent or 12 per cent. of the chicken

ration without causing danger of perosis. If a meat meal containing less phosphate of lime is used the proportion may be correspondingly higher. It is well to bear in mind, however, that conditions of diet such as obtain in groups 29 and 31, Table 6, may be encountered where separated milk is available in large quantities. If a chick mash is used which has been designed to provide the optimum amount of calcium phosphate when fed alone, it may easily produce a condition of perosis or deformed leg bones if copious quantities of separated milk or whey are fed along with it. When separated milk is given *ad lib.* it of course provides for all the protein and calcium phosphate requirements of the growing chick, and in that case other foods very rich in calcium phosphate such as meat and bone meal should not form a large proportion of the diet. Whey *ad lib.* would provide all the calcium and phosphorus requirements, but would not of course supply sufficient protein.

The occurrence of numerous cases of "nephritis" or pale kidney in group 27 (the riboflavin-deficient group) and the complete absence of these symptoms from group 28 getting synthetic riboflavin together with other evidence in this paper, indicates that want of this vitamin can lead, probably indirectly, to a degenerative condition of the kidney cells. That this effect is accentuated when there are large amounts of meat meal in the diet is suggested by comparing the incidence of nephritis in group 9—Table 2—(18 per cent. meat and bone meal) with the lower incidence in group 11 ($12\frac{1}{2}$ per cent. meat and bone meal). Similarly in Table 4, group 21 (15 per cent. meat meal) may be compared with group 26 (8 per cent. meat meal). No reference has been noticed in the literature to a connection between riboflavin deficiency and kidney change. Indeed, Phillips and Engel (18) brought chickens into an acute riboflavin deficiency at the age of six weeks, and having made exhaustive histological examination of internal organs could find no change in the kidneys. Their ration, however, did not contain meat meal, and they mention that in conditions of chronic riboflavin deficiency as contrasted with an acute deficiency, it is possible that degenerative changes in the kidney cell might have supervened.

Whether or not riboflavin deficiency is responsible directly or indirectly for kidney damage, the experiments furnish ample evidence that a moderately high proportion of protein is not of itself injurious, provided that the ration is complete with respect to all known nutritive factors. Thus, there was no indication of kidney disorder in groups 19 (20 per cent. yeast) group 22 (15 per cent. liver meal) group 25 (30 per cent. separated milkpowder), nor was there any definite evidence of "nephritis" in group 28 (15 per cent. meat meal and riboflavin). The occurrence of pale, mottled and swollen kidneys and the degeneration of kidney cells was associated, however, with another dietary factor, namely an excess of calcium phosphate. Thus in the case of the chickens from groups 13, 14, 15, 16 and 17, where 20 per cent. of meat and bone meal with its high calcium phosphate content was fed,

but where foods rich in riboflavin which were given as supplements, prevented the occurrence of the curled toe type of leg weakness the disordered kidney conditions occurred. It is suggested, therefore, that the occurrence of pale, mottled or swollen kidney, or even of evidence of kidney cell degeneration under histological examination, is not proof of any specific nutritional disorder and that the observation is of less diagnostic value than was at one time thought. It is certainly not caused by protein *per se* in the diet. It has been observed on numerous occasions in this department over many years, that simple uncomplicated cases of coccidiosis and also cases of acute enteritis are often accompanied by very pale kidneys. Presumably absorption of poisons from the alimentary canal due to damage of its epithelial tissue can bring about this effect. It has also been well-known for many years that a condition of vitamin A deficiency will produce pale and mottled kidneys. Similar considerations apparently apply to cases of pale kidney or "nephritis" as apply to the case of leg-weakness already discussed—that is, more than one cause may produce the symptoms.

The unexpected result obtained when decomposed meat meal was fed to chickens in groups 33 and 34 (Table 7) is of interest. The commercial meat and bone meal used in our experiment had been thoroughly sterilised during the manufacturing process, and only sound flesh had been used in its manufacture. The results, therefore, may simply represent further proof of the belief that decomposed meat is not toxic provided that it is free from pathogenic organisms and the toxins produced by these organisms. It has been shown conclusively that the "ptomaine" alkaloids are not poisonous unless fed in excessively large quantities. Savage (19) fed a series of kittens with extremely putrid mixtures of canned meat and fish over long periods without demonstrating any signs of toxicity. The real danger arises if the flesh, organs or blood of *diseased* animals are incorporated into meat meals designed for the feeding of farm animals. It is well to emphasise that the cooking of the meat will not destroy some of the virulent toxins produced by disease organisms. Many common diseased conditions such as enteritis and wasting can be caused by organisms which produce such heat-resistant toxins in large amount. The results obtained with groups 33 and 34, therefore, in no way detract from the general recommendation that decomposed or tainted or inferior foodstuffs of any sort should in no circumstances be included in chicken rations.

In the final group of feeding tests, meat meal made solely from horse flesh was compared with that made solely from ox-flesh—groups 35 and 36, Table 8. The fact that there was no difference between the groups was an unexpected result as horse flesh is commonly supposed to be harmful to young chickens, and to cause the onset of a gouty condition. Since neither group made really satisfactory progress it is possible, however, that small differences between the two types of meat meal were masked in this particular experiment.

SUMMARY AND CONCLUSIONS.

1. While in this country there is no legal distinction between meat and bone meal and meat meal, nevertheless the former term is taken to imply a product in which the proportion of calcium phosphate, because of the larger amount of bone incorporated, is higher than that contained in meat meal.

   In the work reported on in this paper the meat and bone meal used contained 40 per cent. to 50 per cent. of protein, about 26 per cent. of phosphate of lime and 3 per cent. oil; meat meal specially prepared and used for comparative purposes in certain experiments contained only 4 per cent. of phosphate of lime but had 70 per cent. of protein.

2. In the manufacture of meat and bone meal the liver which is a very rich source of riboflavin as well as other factors of the vitamin B complex may or may not be incorporated so that the nutritive value of meat and bone meal varies according to the proportion of liver it contains. For this reason results obtained from one sample of commercial meat and bone meal may differ in degree from those obtainable from other samples.

3. Though meat and bone meal contains a variable quantity of riboflavin, generally speaking it is a poor source of this food factor. Consequently a diet made up of meat and bone meals together with oats, barley, and maize, all of which are low in riboflavin, and including salt and cod liver oil, neither of which contains any, is seriously deficient in the riboflavin factor. Chicks reared on such a diet make slow progress, develop leg-weakness associated with curled toe, and show a high mortality rate.

4. The substitution of wheat offals, *i.e.*, bran and pollard which contain a moderate amount of riboflavin for the whole or a considerable part of the oats, barley and maize makes for better progress among the chicks and lessens the incidence of leg-weakness, but optimum growth is not thereby brought about nor is the leg-disorder eliminated.

5. Rich sources of riboflavin are fresh liver, liver meal, dried yeast, milk, fresh young grass, grass meal and alfalfa leaf meal. Hence the advantage in virtue of the extra riboflavin supplied of supplementing the diets mentioned in paragraph 3 with one or more of these foods.

6. When the diet of chickens contains more than 15 per cent. of meat and bone meal, there is a tendency for a proportion of the birds to develop leg-weakness associated with swollen and slipped hock (perosis).

The occurrence of perosis becomes more pronounced as the proportion of meat and bone meal is raised and the disorder is accentuated when a ration containing 20 per cent. of meat and bone meal is supplemented by whey (or presumably by separated milk also). Milk or whey or separated milk alone do not, of course, even when fed in very large amounts, cause perosis. When meat meal containing only a small amount of calcium phosphate replaces meat and bone meal in the above diets perosis no longer appears; the explanation of the occurrence of this disorder in the case of birds consuming a large proportion of meat and bone meal appears to lie in the excessive intake of calcium phosphate possibly accompanied by a relative deficiency of manganese and a shortage of certain vitamins of the B complex.

7. A diet of meat meal (low in calcium phosphate) and of cereals together with the proper proportion of minerals and, where necessary, cod liver oil, while not conducive to perosis does, however, because of deficiency of riboflavin cause the leg-weakness of the curled toe type. Addition of pure riboflavin to this diet eliminates this disorder, but still optimum growth is not obtained. Presumably in this diet other growth factors of the vitamin B complex are not supplied in sufficient quantity for optimum results.

8. Meat meal manufactured under hygienic conditions from the sound flesh of disease-free animals, and allowed to decompose after manufacture is not necessarily toxic to chickens. In the absence of fuller information as to the type of decomposition which took place in the sample under investigation it is emphasised that decomposed foods of any sort should not be fed to chickens.

9. The results on chicken growth and progress are similar whether the origin of the meat and bone meal is the horse or the ox.

10. When incomplete rations containing meat and bone meal give rise to leg-weakness of the curled toe type and likewise when leg-weakness of the perosis type occurs as a result of feeding excessive quantities of meat and bone meal the leg disorders are usually associated with kidney derangement. The kidneys become pale, mottled, and swollen, and the cells of the kidney tissue show serious degeneration. At the same time the ureters are swollen with an accumulation of urates. Chickens so affected usually fall into a state of coma prior to death and develop an abnormally high percentage of uric acid in the blood.

Similar kidney degeneration frequently occurs in the case of chickens suffering from chronic coccidiosis.

It is concluded that this "nephritic" condition is a secondary effect, not specifically connected with the feeding of meat and bone meal. It can be produced by a deficiency of one or more nutritive factors or by excess of others in the diet or be induced by disease.

11. Neither meat and bone meal when fed in proper proportions (not more than 13 per cent. in the ration) nor meat meal is directly responsible for the production of any disorders in chickens. On the other hand both are very suitable foods for chicken feeding, but it must be borne in mind that diets containing these foods can give satisfactory results only when they are made complete with respect to all the various essential nutritive factors including riboflavin and other members of the vitamin B complex. Excess of meat and bone meal should be avoided in the dietary mixture.

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BREEDING, FEEDING AND MANAGEMENT OF SHEEP.

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INTRODUCTION.

The sheep industry resembles the cattle industry in its main outline, although there are certain important differences. We have the same division of the industry into breeding and feeding sections, and the same division of the feeding section into grass feeding and roots feeding. The main differences arise out of the fact that the period which elapses between the birth of a lamb and its consumption is shorter than the corresponding period in the case of beef, and is being steadily reduced. The breeding section of the industry is centred largely in the western counties, although there is a fairly wide distribution of sheep-breeding over the whole country. Sheep are bred in the western counties principally for the store trade and the volume of trade nearly equals that of the western store trade in cattle in those areas.

Sheep are valued commercially for their mutton and wool. With some breeds such as the Merino, wool is the primary product, but the breeds common in Ireland may be regarded as dual purpose, and are kept mainly for mutton, wool being a secondary if still an important consideration. Since mutton is the primary product it seems strange that more attention is not paid to the marketing of this commodity. The marketing of sheep is very similar to that of cattle, the auction or fair being the only means of sale. Any attempt at grading or selling by dead-weight would in all probability meet with little response. The simplest grading system is by weight, sex, and age. Nature has obligingly provided the sheep with a convenient test of age, namely the "break joint," one of the joints of the foreleg. Up to twelve months this joint breaks in four well-defined ridges, smooth, moist, and red with blood, with yearlings the ridges are rough, dry and not red ; with aged mutton the joint does not break at all. Age and weight, however, are only some of the factors which determine quality ; and the most important factor, "goodness," is not easily measurable. The terms "Select and Prime" are often used to denote quality, but the definitions of these qualities are so vague that grading in these terms is not entirely satisfactory.

The principal mutton-exporting countries grade their exports according to these features, and in the post-war years Irish mutton is likely to meet with considerable competition in the British market from New Zealand and Argentine mutton, and it is accordingly, of the utmost importance for Irish

sheep farmers not to rest content with their present standards of production, but to look ahead and strive to make improvements in anticipation of this keener competition from overseas in the future. Two obvious lines of advance suggest themselves: One is to improve the general level of breeding and feeding, and the other to organise an attack on disease. The quality of sheep, under the conditions which seem likely to prevail for some time obviously rests with the quality of the ewe and the ram she is crossed with. Here I may add it is not so much the particular breed the ram belongs to, but the constitutional make-up of the ram himself that determines his efficiency as a breeding animal. The ewe will be judged by her capacity to produce early-maturing lambs, her fertility rate and her resistance to disease.

There is a marked tendency amongst farmers to resort to indiscriminate crossing in order to produce lambs as cheaply as possible. Some first crosses are becoming more popular each year because the progeny of judicious crosses seem to show more vigour, and oftentimes inherit the better qualities of both parents. Such animals while excellent for the production of high-class mutton should never be retained for breeding purposes. This, unfortunately, is not the case, as a casual inspection of the breeding flocks throughout the country will show many of the breeding ewes to be of very mixed blood.

Disease adds considerably to the cost of lamb production since, besides taking a heavy toll of young progeny, it is one of the chief factors determining the rate of depreciation of ewes. There seems to be two important aggravating causes of disease among sheep. One is overstocking on grass, which may lead to extremely heavy losses, due to parasitic infection, and the other is malnutrition, arising frequently from deficiencies in our upland pastures, and can be mitigated by the improvement of the pasture itself. Sheep farming stands to gain much from the technical developments in grassland management.

From the foregoing it is evident that the problems of breeding, feeding and management of sheep are as fundamental as in any other branch of the livestock industry.

Breeding.

It seems necessary to begin this subject with an explanation of the names that are applied to sheep of the different sexes at the various ages.

Age in sheep is usually reckoned from the time of shearing, which in this country is normally done for the first time when the animal has attained the age of fourteen to sixteen months, and at yearly intervals thereafter. The term lamb is not very precisely limited, being sometimes confined to the pre-weaning period, and sometimes extended to cover the first six to ten months of the animal's life. In certain districts lambs become hoggets on the advent of the new lamb crop. The sex is also denoted, males being known as ram lambs; castrated males as wether lambs; and females as ewe lambs.

Males of a year old, or after shearing for the first time, are termed hoggets or shearling rams. The female at shearing becomes a ewe hogget, and castrated males as wether hoggets. Thereafter we have two-shear, or three-shear rams, ewes or wethers. Ewes are sometimes distinguished according to the number of crops of lambs they have borne, as two crop, three crop, etc., the first lamb being borne at two years old. Again in some districts it is customary to denote age by the teeth, as two tooth, four tooth, etc. In sheep the permanent incisor teeth are usually set as follows, though heavily fed sheep may set their teeth earlier, or mountain sheep later.

First or Central Pair	12-15 months.
Second Pair	18-21 ,,
Third Pair	24-27 ,,
Fourth Pair	33-36 ,,

Sheep-breeding may be divided into two classes :—

(1) Production of Early Fat Lambs.
(2) Production of Store Lambs—the females to be retained, or sold for breeding purposes, and the males to be fattened before they reach the age of two years.

Success in either of these classes will depend to a great extent on the breeder's ability or skill in selecting the most suitable type of ewe for the purpose intended, as well as mating her with the best ram obtainable. A breeding ewe should possess the following characteristics :—

(1) Sound mouth (in aged ewes).
(2) Compact body on fairly short legs.
(3) Sound udder (in aged ewes).
(4) Medium size.
(5) Active and hardy.
(6) Sound constitution—Lack of constitution or unthriftiness is often exhibited in sheep by the tendency to lose the juice of the grass.

Production of Fat Lambs.

The breeding of early fat lambs is governed by a number of factors which are dealt with later in this article. Cognisance of these factors must be carefully taken before launching out on this branch of the industry. The fundamental principle underlying the production of early fat lambs is to combine by judicious crossing the highly desirable properties of early maturity and good carcase quality. Fortunately this can be achieved by the mating of many different breeds, but I will confine my selections to those breeds available to all Irish farmers and which are as follows :

(*a*) Cheviot Ewes x Suffolk Ram.
(*b*) Galway Ewes x Suffolk Ram.
(*c*) Cheviot Ewes x Border Leicester Ram.

Production of Store Lambs.

The vast majority of our sheep-breeders are engaged in this branch of the industry, due no doubt to the fact that no limiting factor such as food shortage comes into play. The type of lamb produced is determined by the demand and the breeder who supplies this demand will reap the reward financially. In recent years demand for the Down crosses has far exceeded that for the Galway or Roscommon, with the result that ewes of the latter breeds are now very widely used for crossing with Oxford or Suffolk Down rams. This practice is not to be condemned, on the contrary it should be encouraged, but the sad feature is, as already stated, that many such cross-bred ewes are used to replenish the breeding-flock. It is quite obvious that sheep-farmers in many districts have seen the folly of this practice, and the advantage to producers of the Down Crosses may prove ephemeral in the near future, because breeders of the Galway and Roscommon may offset the relatively small loss on their wether-lamb or hogget crops, by a large increase in the price obtained for their ewe-lambs or hoggets. The following are a few mating selections for store-lamb production :—

(a) Galway Ewes x Oxford Down Ram.
(*b*) Galway Ewes x Suffolk Down Ram.
(*c*) Galway Ewes x Galway Ram.
(*d*) Roscommon Ewes x Oxford Down Ram.
(*e*) Roscommon Ewes x Roscommon Ram.
(*f*) Border Leicester Ewes x Border Leicester Ram.

Mating.

The average period of gestation in sheep is approximately 147 days, varying a day or two with the breed. Females are normally mated for the first time as ewe hoggets to lamb at two years old. Ewe lambs in good condition will often take the ram in early winter, and will lamb at a little over a year; but breeding so early is usually unprofitable in the end, as it is rare for more than 60 per cent. or 70 per cent. of the ewe lambs to conceive, and as these are apt to suffer considerably in their development the practice is not to be recommended. Ram lambs are usually used for breeding purposes at seven months old, but the number of ewes allotted to them should not exceed twenty. Hogget or aged rams, provided they remain active, may be mated with from forty to fifty ewes.

The time of mating is limited in part by the time of occurrence of heat in the ewe. Thus the Dorset Horns will often come in season in May, Dorset Downs and Hampshires as early as June or July, while Mountain Ewes rarely come until late September or even well on in October. Apart from this, the time for mating is fixed by the breeder in accordance with the climate and food conditions prevailing in spring. Again, the object for which the sheep are kept, will have an important bearing on the time of service. If a breeder aims at early fat lamb production for the Easter market, the ewes will have

to be served in August, so that the lambs are dropped early in January. On the other hand, if store lamb production is the breeder's goal, the date of service is regulated so that the lambs arrive during late February or early March. Rams should be left in the flock for approximately six weeks, which is usually long enough to ensure that all ewes will be pregnant. The period of oestrum in the ewe lasts about twenty-four hours and recurs, if she does not conceive, after about sixteen days. A six weeks breeding season thus covers at least, two, and in the majority of cases three oestrous periods. Where ewes will have close attention at lambing it is necessary to record the dates of service. With this object in view the ram is raddled between the forelegs so that a mark is left on each sheep served. At the end of each week the ewes that have been served are given a special mark which remains until the spring as an approximate indication of the date of lambing. At the end of sixteen days the colour of the raddle should be changed so that all ewes not holding to the first service can be immediately identified by the presence of the two colours. As a precautionary measure it is always best to trim neatly and remove all daggs from the ewes before allowing them out to the ram. If a large number of ewes are being twice marked another ram should be procured as soon as possible to guard against serious loss. In large flocks it may be necessary to run two or even three rams together, and it is always advisable that the rams be kept together for some time previous to running with the ewes, as this greatly reduces the risk of fighting. Under ordinary conditions the proportion of barren or "dry" ewes should not exceed 3 per cent.

The numbers of doubles, or twins, depends partly on the inherent fecundity of the ewes, and partly on their treatment before and during the mating season. The smallest number of lambs will be obtained when the ewes are lean and weak, very fat, or are reducing in condition. On the other hand, the highest birth rate is obtained if the ewes at mating time are in a moderately lean but rapidly improving condition. This is assured if the sheep have been kept in a low condition after the previous weaning, by bringing them on gradually until within a week or two of service, and then by "flushing" on rich aftergrass, rape or other succulent nutritious foods. "Flushing" causes an increased proportion of the ewes to breed early, *i.e.*, at the season when there is the greatest possibility of multiple ovulations. The possibility of two or more ova being produced during the oestrous period is greatest in the early part of the breeding season, thus explaining the well-known fact that more doubles are usually born at the beginning than at the end of the lambing season. Delay in mating after the ewes begin to come in use will thus reduce the proportion of twins.

Care of Ram.

Rams often require special attention during the breeding season and a particular watch must be kept for foot-rot, more especially on the hind

legs, because if this is allowed to become chronic the ram may refuse to serve any ewes. If overworked, the ram may reduce in condition, in which case it is always advisable to supplement his food with a little concentrates, *e.g.*, $\frac{1}{2}$ to $\frac{3}{4}$ lb. per head, per day, of equal parts of bran and crushed oats. Speaking from practical experience I should never recommend the feeding of roots to the ram at this period as they usually cause the formation of a stone in the genital tract with the result that the animal becomes temporarily sterile.

Care of Ewes.

During the gestation period the ewes are fed mainly on hay and grass. In the sheep-rearing districts of the West of Ireland, well saved upland meadow-hay is made into what is known as a sheep-cock, *i.e.*. a long pole is sunk firmly in the ground and the hay cock is built round it and neatly thatched to secure it against the ravages of the winter. During the winter the sheep eat the lower portion of the cock which gradually slips down along the pole, thus always ensuring that there is a fresh supply at the disposal of the sheep. The site for such a cock is in all cases the driest obtainable in the particular field with the result that there is very little waste if the cock is occasionally trimmed. At all times of the year, but especially during the winter months, it is necessary for best results to keep breeding ewes on dry land. Sheep kept on dry land are much less likely to be affected with fluke or to suffer from lameness due to foot troubles. If breeding ewes are reducing in condition it may be necessary to supplement the hay and grass with some concentrates, but the quantity must be limited, as excess roots or concentrates are often responsible for much trouble in the breeding ewes, *e.g.*, Prolapsis of uterus or expulsion of the womb. The following ration is a suitable one for pregnant ewes. $\frac{1}{2}$ to $\frac{3}{4}$ lb. per head, per day, of equal parts of crushed oats and sugar pulp.

During pregnancy, and more particularly as the time of parturition draws near, breeding ewes should be disturbed or frightened as little as possible and never roughly handled so as to avoid injury and consequent loss through abortion. During the last few weeks of pregnancy ewes sometimes get on their backs and once in this position they are unable to regain their feet. Unless the animals are raised they will die in a short time. To guard against this trouble sheep should be seen frequently. When lambing occurs the ewes should be kept under constant supervision and assistance in lambing should not be given unless absolutely necessary as in the case of protracted labour or false presentation. Immediately on lambing all wool should be removed from the udder so as to avoid the formation of wool-ball in the lamb's stomach. It is also advisable to see that the ewe has the milk to rear the lambs and this can be ascertained by gently drawing the teats. In the case of weak lambs it is often beneficial to feed on a dilute mixture of whiskey, water, and milk drawn from the mother. The proportion of weak lambs will be greatly

reduced if measures are taken to prevent young lambs from getting rain until the coat has sufficiently dried after birth. According as each ewe drops she should be changed to some field which was closed since the previous autumn, because grass is the most satisfactory food for milk production. If such is not available concentrates to the extent of 1 lb. per head, per day, may be given without injury and a very suitable ration is made up as follows:—Equal parts of crushed oats, sugar pulp and linseed cake. Sheep usually get their water requirements from plant sap, rain and dew, but in spells of prolonged drought they will freely drink, and water should be always available.

Generally there will be a proportion of triple births as well as a few orphan lambs. On the other hand there will be many singles and a few ewes whose lambs die. There should be a reassortment, by transferring lambs so that the flock is made to consist entirely of singles and doubles. In cases where a lamb has died its skin should be tied over the back of the stranger, when the latter will be adopted immediately. Other devices such as that of rubbing the ewe's nose with turpentine to deprive her temporarily of her sense of smell or placing her with the adopted lamb in a house with a dog, are occasionally successful. At the age of three weeks to a month old the lambs' tails should be cut, and the males not required for breeding purposes should be castrated, when weather conditions are favourable. In mountain breeds the tail is cut so that it reaches to about hock-level, so that it can afford protection to the udder, but in the lowland breeds, three or four joints of the tail are sufficient to leave. This procedure is not necessary if the lambs are sold fat for the Easter trade. It is desirable that ewes and ewe lambs which it is not intended to retain or sell for breeding purposes should be segregated from the rams and ram lambs kept in the flock. This segregation could probably be best effected when the lambs are being weaned and before the breeding season commences. Ewes and ewe lambs purchased for fattening often prove to be in young with the result that purchasers suffer severe financial loss.

Shearing.

Of the various special tasks of the summer season shearing is the first. In the South of Ireland this is done as early as the beginning of May, and in the West about the first week of June. Sheep may be either washed in running water a week before clipping or may be shorn in the grease. The difference in the price of washed and greasy wool will always repay the labour of washing, even though there may be a loss of weight of from 10-15 per cent. if the washing is done thoroughly.

Before washing, all dirty wool should be removed. A sheep is washed thoroughly only when the water runs away clear of all cloudiness. If clipping is delayed longer than ten days after washing, the yolk will again begin to

rise in the wool, producing a greasy condition, practically similar to that of unwashed wool.

Whenever possible, shearing should be done on a clean, boarded floor or platform, and if this is not available the operation should be carried out on a cart or rick cover, so as to ensure against the possible inclusion of straws or other litter. Vegetable impurities such as these or jute fibres from sacks, or binder twine, are all very objectionable in wool since they do not absorb dyes in the same manner, and their presence in large quantities may render it necessary for the wool to be carbonised in order to destroy them. The time occupied in shearing depends on the type of wool that the sheep carries, and on the machine used in the operations. With short wools, when using a hand-shears, slightly less than two score will represent a day's work for a good shearer, but if power-driven machines are used the number clipped will far exceed this and as a rule due to greater efficiency the fleece will be heavier. In the case of our native long-wooled sheep the average clip for a ewe is 7-8 lbs. and for a hogget 10-12 lbs. When a fleece is clipped it should be placed skin or cut side down, and all broken locks on the edges should be removed before the sides of the fleece are turned in. The fleece is then rolled up from the tail to the neck with the cut side out. A tie is made by drawing out and twisting the neck wool which is then placed neatly around the fleece and fastened. Fleeces of Scotch black-face wool are an exception to this rule, being rolled skin or cut side in. Before releasing a sheep after shearing it should be branded for future identification but tar should not be used as it injures the wool. Anyone of the proprietary marking-fluids are sufficiently indelible and can be recommended for use. Surely it is not asking too much of the sheep farmer to carry out these recommendations, but unfortunately he is rather slow to realise that it would be to his own economic advantage to market the secondary product of the sheep in the best possible condition.

Maggot Fly.

From June to the end of September one must be continually on the watch for sheep that have been "struck" by the maggot-fly and the effected parts must be dressed as early as possible. Apart from preventive dripping, which is not a success, the clipping off of the locks of dirty wool from about the hind quarters is important as the fly is attracted by dirt, and smell. No really effective deterrent against the fly has been discovered, though recent research work holds out some hope of useful results.

Weaning.

Weaning is generally done when the lambs are about four months old, *i.e.*, between the 1st and middle of July. At weaning time the ewes are put out on poor bare pasture in order that the flow of milk may be dried off while the lambs are either sold as stores or put on clean pasture for sale in the autumn. The ewes may have to be milked a few times before they are

finally dried off, but the interval betwen each milking must be increased. Most of the aged and cull ewes are disposed of at special sales in August or September.

Dipping.

To comply with the law every sheep-owner in this country must double dip his sheep within a period of fourteen days between the 1st of August and the 31st October, each year. This dipping is principally a preventative measure against "Sheep Scab," but such treatment will have a beneficial effect upon the general health of the sheep, by destroying other skin parasites from which sheep frequently suffer. Many of the Dips used contain arsenic, and since this substance can be assimilated by the sheep through the body pores, and is, in addition, an accumulative poison, it may be advisable to use a tar-oil or non-poisonous Dip for the second dipping. Coloured, or "Bloom Dips" permanently stain the wool, and their use has now been prohibited. Minor skin wounds or sores can be smeared with grease before the sheep are dipped. If sheep have been driven a journey to the place of dipping it is always best to allow them to cool off before dipping as there is then less likelihood of their swallowing the dip. The minimum time of immersion is two minutes, and the sheep should be allowed to drain off thoroughly before being put out on pasture.

Fattening.

The points of a mutton sheep correspond closely to those of a fat bullock, the desirable qualities being a tendency to early maturity, a thick covering of lean meat, and an even distribution of adipose tissue or fat.

The head should be of good depth and width, strong of jaw; and broad through the nose ; the neck short and thick ; the body deep, wide and square ; the shoulder-top wide, level and well covered ; the chest deep and wide, and the ribs well sprung or rounded ; the shoulder neatly laid, and the region behind the shoulder well filled up ; the hind quarters long, broad and level, with the hips far apart ; the thighs thickly fleshed and the flesh well carried down. The back should be broad and level, covered with muscular flesh ; the legs straight, short, wide apart, the bone clean, and not too fine. The thickness of the tail and the fulness of the purse or scrotum are an indication of condition. The general appearance should indicate activity and robust health.

Sheep may be prepared for the butcher at any age from twelve weeks onward. The earliest fat lambs are killed at about twelve weeks old, and few sheep, except ewes that have been used for breeding purposes, are now older than twenty-four months when they reach the market.

The earliest fat lambs are usually the produce of aged ewes and are fattened on milk, plus whatever concentrates they receive while their dams

are being fed. Early lambs of this kind weigh usually 70-80 lbs. live weight 35-40 lbs. dead weight at twelve weeks old. This type of lamb is succeeded on the market by selected single lambs dropped at a later date. In both of these cases there will have been no store period, the process of rearing and fattening having been combined. Hoggets are often carried on as stores over the autumn and fattened during the winter months. In most markets under present conditions a fat live weight of not more than 130 lbs. should be aimed at. The following are examples of winter fattening rations, based on a live weight of 100 lbs. Each ration supplies about $2\frac{3}{4}$ lbs. of dry matter, about 1.6 lbs. of starch equivalent, and .25 lbs. of protein equivalent. On rations such as these a live weight increase of .3 lbs. per day or rather more than 2 lbs. per week, may be expected.

Ration 1.

14 lbs. Swedes.
$\frac{1}{2}$ lb. Good Meadow Hay.
$\frac{1}{4}$ lb. Flaked Maize.
$\frac{1}{4}$ lb. Cotton Cake.
$\frac{1}{4}$ lb. Dried Grain.
1 per cent. Salt.

Ration 2.

14 lbs. Swedes.
$\frac{1}{2}$ lb. Hay.
$\frac{1}{2}$ lb. Crushed Oats.
$\frac{1}{2}$ lb. Linseed Cake
1 per cent. Salt.

Hoggets in wool may yield from 50 per cent. to 55 per cent. of their live-weight as dressed carcass. Newly-shorn sheep give about 5 per cent. more and heavy fat wethers may dress up to 65 per cent.

Ranganna Talṁaíoċta Geiṁriḋ.

Suas go dtí an naoṁaḋ aois déag ba beag an spéis a cuirtí i n-eoluíoċt agus ní bréag a ráḋ gur ṡúaraċ an baint a ḃí ag eoluíoċt le talṁaíoċt nó le tionscal. Is mór an dul ar aġaiḋ atá déanta ó ṡoin i leiṫ, agus tá toraḋ na h-eoluíoċta le feiscint go soiléir an lá atá inniu ann i ngaċ gné de ṡaoġal na ndaoine. Céad bliaḋain ó ṡoin, ḃí feirmeóirí an doṁain ṁóir ag braṫ ar úirlisí sean-aimsearḋa ċun a gcuid oibre a ḋéanaṁ agus ba beag leasú a ḃí le faġáil aca seaċas aol agus aoileaċ. Maidir leis na galraiḃ a ḃí ag gaḃáil do's na barraí agus do's na beiṫíḋiġ, ba beag leiġeas fóġanta a ḃí ag ár sinnsir. Nuair a deintear maċtnaṁ ar na h-úirlisí, ar na leasuiṫe agus ar na leiġeasanna a ḃíonn le faġáil anois ní foláir a aḋmáil gur iongantaċ an t-aṫrú atá tagaiṫe ar ḟeirmeóireaċt de bárr na h-eoluíoċta.

Níorḃ fiú trácht ar an iomaíoċt a ḃí idir na náisiúin sa tsean-aimsir i gcúrsaí talṁaíoċta. Is aṁlaiḋ a ḃíoḋ beagnaċ gaċ tír ag seasaṁ ar a bonnaiḃ féin i gcúrsaí biḋ. Le céad bliaḋain anuas, áṁtaċ, tá feaḃas mór tagaiṫe ar ċóireaċa iomċuir ar muir agus ar talaṁ agus le tamall maiṫ de ḃliaḋantaiḃ roiṁ an gcogaḋ ḃí ar ḟeirmeóirí na hÉireann dul i n-iomaíoċt le feirmeóirí an doṁain ṁóir, agus go mór-ṁór le feirmeóirí na Danmairge, le feirmeóirí Nua Séalainne, le feirmeóirí na h-Astráile agus le feirmeóirí Tír an Airgid. Do réir gaċ dealraiṁ is ag dul i ndéine agus i ngéire a ḃeiḋ an ċoiṁlint san am atá le teaċt agus má's mian le feirmeóirí na tíre seo ár riaċtanaisí biḋ féin do ṡoláṫar coṁ mór agus is féidir é, agus greim doċt daingean d'faġáil ar na margaí iasaċta, ní mór dóiḃ beiṫ oilte eolgaiseaċ ar a ngnó.

Gléasanna Oideaċais Talṁaíoċta.

Tá cúrsaí breáġta iolscoile le faġáil i dTalṁaíoċt sa tír seo aċ cosnuiġeann siad pinginn ṁór airgid. Na fir óga a deineann na cúrsaí seo bíonn sé ar intinn aca de ġnáṫ postanna d'faġáil mar teagasctóirí nó mar ċigirí talṁaíoċta agus is annaṁ a ṫéiġeann duine aca ṫar n-ais go dtí feirm a aṫar ċun sliġe beaṫaḋ a baint amaċ dó féin as an dtalaṁ. Tá oċt gcinn de coláistí nó de scoileanna talṁaíoċta scaipiṫe ar fud na tíre, leis. Tá ceiṫre cinn díoḃ seo fé stiúrú an stáit agus ġeiḃeann an ċuid eile díoḃ cóngnaṁ airgid ó'n Stát. Buaċaill go ḃfuil beartuiġṫe aige a ḃeaṫa a ḃaint amaċ ar ḟeirm, tá cúrsa maiṫ talṁaíoċta le faġáil aige i gceann ar biṫ de's na scoileanna seo ar ċosdas ana-réasúnta. Tá aḋḃ sa scéal, áṁtaċ, ó's rud é ná fuil ins na scoileanna seo ar faḋ aċ sliġe do 300 buaċaill nó mar sin. Tá breis is 384,000 gaḃáltas sa tír, agus meastar go ngaḃann os cionn 10,000 feirmeóir óg seilḃ ar ḟeirmeaċa a n-aiṫreaċa gaċ bliaḋain. Is léir ó's na figiúirí seo naċ féidir aċ le fíor-ḃeagán de's na feirmeóirí

óga bliaḋain a ċaiṫeaṁ ar ċoláisde nó ar scoil. Cad é an gléas oideacais atá againn ċun eolas a ċéirde a ċur ar fagáil do'n aḋbar feirmeóra nać féidir leis tréimse a ċaiṫeaṁ as baile?

An Rang Talṁaíoċta Geiṁriḋ.

Níorḃ fada a ḃí an Roinn Talmaíoċta fé réim i n-Éirinn nuair a ceapaḋ an rang talṁaíoċta geiṁriḋ mar gléas ċun fios a ċéirde a taḃairt do ṁac an feirmeóra. Níorḃ féidir gluaiseaċt aċ go mall righin i dtosaċ báire, toisc gan teagascṫóirí talṁaíoċta a ḃeiṫ le fagáil. B'é an ċéad niḋ a ḃí le déanaṁ ag an roinn ná teagascṫóirí d'oileaṁaint. Bíonn gaċ tosnú lag agus i mbliaḋain 1902-3 ní raiḃ aċ dá rang ar siuḃal—ceann aca i nÓgmág agus an ceann eile i Muineaċán. An bliaḋain na diaiḋ sin—1903-4—do cuireaḋ 7 ranganna ar siuḃal sa tír. I ndiaiḋ a ċéile do ċuaiḋ na ranganna i n-iomadaṁlaċt agus i mbliaḋain 1913-14 do ḃí 84 ranganna sa tír ar fad (32 ċonndae). Cé gur ċuir na cogaí isteaċ ar na ranganna toisc na teagascṫóirí ḃeiṫ sáitte i ngnóiṫiḃ eile a bain le cúrsaí biḋ, níor leigeaḋ ar lár iad i n-aon ḃliaḋain ó ṡoin. Ḃí 143 ranganna sa tír seo (26 connDaiṫe) sa ġeiṁreaḋ seo gaḃ ṫarainn.

Cad is Rang Talṁaíoċta ann?

Is iad na Coisdí Talṁaíoċta i ngaċ conndae a stiúruiġeann na ranganna so. Bíonn siad ar siuḃal ó ṫosaċ Mí na Saṁna go dtí deire Mí Feaḃra agus bíonn cead ag buaċaillí tuaiṫe tar 15 bliaḋna d'aois freasdal orṫa gan faic a ḋíol. Bíonn teagasc le fagáil ins na ranganna ar ithreaċa, ar leasuiġṫe, ar earraí biḋ, ar ṡíolta, ar na barraí, ar ċineálaċa stuic, ar ḃeaṫú stuic, ar na galraiḃ a tagann ar barraí agus ar ḃeiṫiḋiġ, ar ḋeiríoċt, ar ṡuirḃéireaċt talṁan, ar ċunntaisí feirme, ar ġarradóireaċt, ar éanlaiṫeóraċt agus ar na scéimeanna éagsaṁla atá i ḃfeiḋm ċun feirmeóireaċt d'feaḃsú. Ní h-é an clár oibre céadna a ḃíonn i ngaċ rang mar ḃíonn sé de ċead ag na teagascṫóirí aṫruiġṫe a ḋéanaṁ ar an gclár do réir riaċtainsí an ċeanntair. Bíonn somplaí de ṡíolta feirme, de leasuiġṫe, de plandaí galruiġṫe, d'féara, agus mar sin de, ag na teagascṫóirí ċun na ceaċtanna do léiriú. Bíonn lóċrann draoiḋeaċta ag cuid de's na teagascṫóirí, leis, ċun peictiúirí a baineann le feirmeóireaċt do ṫeasbáint.

Ranganna Lae nó Oiḋċe?

Nuair a bunuiġeaḋ na ranganna talṁaíoċta ar dtúis ba ġnáṫaċ iad a ḃeiṫ ar siuḃal sa ló ar feaḋ ceiṫre uair an ċluig nó mar sin, dá lá sa tseaċtṁain. Ba deaċair tinnreaṁ maiṫ d'fagáil insna ranganna lae. Ó'n mbliaḋain 1902-3 suas go dtí 1924-25 ní raiḃ aċ ranganna lae ann, agus b'é an meaḋon-uiṁir a ḃí ar rollaí na rang ná 15. I mbliaḋain 1925-26 do cuireaḋ ranganna oiḋċe ar siuḃal i gcuid de's na Conndaeṫe agus ó ṡoin i leiṫ ba istoiḋċe a ḃí an ċuid ba ṁó de's na ranganna ar siuḃal. Ó'n mbliaḋain 1925-26 go dtí bliaḋain 1944-1945 is é an uiṁir a ḃí ag freasdal ar na ranganna sa meaḋon

na 27. Is léir uaiḋ seo gur fusa go mór na feirmeóirí óga do ṁeallaḋ isteaċ ins na ranganna oiḋċe. Claoiḋeann an Coisde Talṁaíoċta i gConndae Ċiarraiġe leis an rang lae fós agus ábhar maoiḋiṁ agus mórtais do ṁuintir na conndae sin go mbíonn tinnreaṁ sásaṁail le faġáil ann de ġnáṫ.

Bíonn buntáistí áiriṫe ag baint leis an rang lae. Ar an gcéad dul síos, bíonn 50 uair an ċluig ar a laiġead de ṫeagasc le faġáil ann seaċas 30 uair ins an rang oiḋċe. Rud eile, bíonn solus na gréine ann ċun siolta beaga agus plandaí agus rudaí eile mar sin do scrúdú. Is follus, dá bríġ sin, gur féidir cúrsa níos fearr a ṫabairt sa lo. Ar an dtaoḃ eile de'n scéal, is beag áit 'na mbíonn hallaí nó tiġṫe oireaṁnaċa le faġáil le h-aġaiḋ na rang so. Ní misde a ráḋ go mbíonn dá ḃuaḋ ṁóra ag gaḃáil leis na ranganna oiḋċe ó's rud é go mbíonn deag-ṫinnreaṁ ionnta de ġnáṫ agus go mbíonn na scoileanna náisiúnta le faġáil istoiḋċe.

Ní furist cúrsa iomlán a ṫabairt istoiḋċe coisc gan deag-ṡolus a ḃeiṫ ann. Ċun an loct so do laġdú, is gnáṫaċ na mic-léiġinn do ḃailiú le ċéile uair nó dó nuair a bíonn solus an lae ann ċun teasbántas d'ḟeiscint i ngarradóireaċt, nó b'féidir ċun páirc a ṫomas nó ċun féara agus fiaḋaile agus mar sin de do scrúdú ins na páirceanna. Is minic, leis, a bíonn comórtas treaḃṫa ag rang talṁaíoċta. Dá minicíġe a bíonn cruinniġṫe amuiġ fé'n aer ag na macaiḃ léiġinn 'seaḋ is fearr do'n rang.

I gcásanna áiriṫe, leis, tugann an teagasctóir talṁaíoċta na mic-léiġinn ar ċuairt go dtí feirm ṁaiṫ sa ċóṁarsanaċt nó go dtí coláiste talṁaíoċta. Roiṁ an gcogaḋ tugtaoí na ranganna ó ċuid de's na conndaeṫe ar turas go dtí an Teasbántas Carraiġ i nDroiċead na Doṫra gaċ bliaḋain.

Na Teagasctóirí.

Is é an teagasctóir talṁaíoċta a bíonn i mbun na rang talṁaíoċta agus ní mór cúpla focal a ráḋ 'na taoḃ. Mac feirmeóra 'seaḋ é de ġnáṫ go bfuil éirim aigne ṫar bárr aige. Do tógaḋ le feirmeóireaċt é agus dein sé gaċ saġas oibre ar feirm a aṫar i dtús a ṡaoġail. B'féidir gur freasdail sé ar rang talṁaíoċta 'na paróiste féin agus gur cuireaḋ na luiġe air annsin a tábaċtaiġe atá oideaċas i gcúrsaí feirmeóireaċta. Is dóċa gur ċaiṫ sé bliaḋain i scoil talṁaíoċta agus b'féidir bliaḋain eile sa Ċoláiste Talṁaíoċta i nGlas Naoiḋean. Ċun an céim i dtalṁaíoċt do ḃaint amaċ bí air an scrúdú máiṫreánaċ do ḋéanaṁ agus, 'na diaiḋ sin, ceiṫre bliaḋanta a ċaiteaṁ i gColáiste na hIoscoile ag déanaṁ staidéir ar gaċ brainnse eoluíoċta, innealtóireaċta agus economuíoċta a baineann le talṁaíoċt. Pé oileaṁaint a fuair sé roiṁ-ré is fíor a ráḋ ná fuil teagasctóir sa tír indiu nár ċaiṫ tréimse fada i gColáiste Ollsgoile nó i gcás na sean-teagasctóirí i gColáiste na hEoluíoċta i mBaile Áṫa Cliaṫ. Ní féidir le héinne a ráḋ ná fuil cúrsa iomlán, il-ġnéiṫeaċ déanta aige agus ní h-iongnaḋ go mbíonn sár-eolas aige ar a ġnó. Cóṁ maiṫ le sin bíonn seans fé leiṫ

aige a ḃeiṫ ag cur le n-a ċuid eolais mar ḃíonn sé ag gabáil timċeall i measc na bfeirmeóirí i gcómhnuiḋe ag stiurú trialaċa ar ḃarraí, ar leasuiġṫe agus ar ḃeaṫú stuic, agus ag tabairt cómhairle uaiḋ ar na céadta ceist a bíonn ag déanaṁ buaiḋearta do'n ḟeirmeóir. Tuigeann se aigne an ḟeirmeóra go cruinn agus pé mar aduḃraḋas na ṫaoḃ tamall maiṫ ó soin—"Bíonn sé 'na treóraí, 'na eagnaí agus 'na ċara do'n ḟeirmeóir." Cá bfagfaí múinteóir níos fearr ċun an rang talṁaíoċta do treórú?

Is é an teagascṫóir talṁaíoċta a deineann an ċuid is mó de'n ṁúinteóraċt sa rang talṁaíoċta aċ tugann na teagascṫóirí eile lám ċongnanta dó. Geiḃeann na mic léiġinn léiġeaċt ar éanlaiṫe clóis o'n dteagascṫóir éanlaiṫeóraċta. Tagann an teagascṫóir garradóireaċta go dtí an rang uair nó dó ċun teasbántas a ṫabairt ar ċúrsaí garradóireaċt. I gcuid de's na conndaeṫe tugann sréad-liaiġ cáiliṫe cúpla léiġeaċt do luċt an ranga, leis.

AḊḂAR DÓĊAIS.

Do scrioḃ saoi fadó: "Tá an intleaċt beirṫe leis an duine agus tigeann stuaim le cleaċt agus is í an oileaṁaint a raċuigeas gaċ aon ċuid aca." Is dóċa naċ gáḋ a ráḋ gur mór an oscailt aigne agus oscailt súl d'aon buaċaill freasdal ar rang talṁaíoċta. Ní h-é amáin go bfagann sé ana-ċuid eolais i dtaoḃ a ċéirde sa rang aċ 'na ṫeannta san cuirtear faoḃar air ċun leaḃair agus páipéirí feirmeóireaċta do léiġeaṁ agus ċun tuilleaḋ eolais d'fagail. Cuirtear ag maċtnaṁ é ar ċeisteanna talṁaíoċta agus diaiḋ ar ndiaiḋ méaduiġtear a cumas féin ċun deacraċtaí do réiḋteaċ dó féin. Ṫar gaċ niḋ eile cuirtear 'na luiġe air gur spéiseaṁail agus gur uasal an gairm-beaṫaḋ atá aige.

Caḋ é tuairim an pobail ar ranganna talṁaíoċta? Ní beag mar freagra ar an gceist seo a ráḋ go raiḃ 3850 mac léiġinn ag freasdal ar 143 ranganna 'sa ġeiṁreaḋ seo gaḃ ṫarainn. Aḋḃar dóċais dúinn-ne go raiḃ i bfad níos mó ranganna agus go raiḃ a bfad níos mó daoine ag freasdal orṫa i mbliaḋna ná i n-aon ḃliaḋain eile roiṁe seo. Ní ċeart áṁṫaċ, ḃeiṫ sásta go dtí go mbeiḋ caoi ag gaċ aḋḃar feirmeóra freasdal ar rang roiṁ dul i mbun feirme dó. Aċ ní féidir an cuspóir seo a baint amaċ muna mbíonn breis teagascṫóirí againn. Is iad na Coisdí Talṁaíoċta a fostuigeann na teagascṫóirí agus go dtí le déiḋeanaiġe ḃí cuid de's na Coisdí seo go patċuar agus ar nós cuma liom i dtaoḃ oideaċais. Tá cómharṫaí ann, áṁṫaċ, go bfuil tábaċt na rang ag dul i bfeiḋm ar na coisdí agus b'féidir go gceapfar an líon teagascṫóirí is gáḋ gan puinn moille amaċ annso.

Aċ caḋ mar ġeall ar ċostas na rang so? Is é an príoṁ-ċostas atá ann ná tuarasdail na dteagascṫóirí aċ ní mór cuiṁneaṁ go ndeineann na h-oifigiġ seo a lán dualgaisí eile seaċas na ranganna a ṁúineaḋ. Leasmuiġ de ṫuarasdail na dteagascṫóirí, níor ċosnuiġ na ranganna talṁaíoċta aċ

£5 13 an rang sa ṁeaḋon i mbliaḋain 1943-44. An té a ṁactnuċaḋ ar ṫábaċt na rang so ní ṁaoiḋfeaḋ sé an costas.

Is léir ó'n méid atá ṫuas go ḃfuil buaḋanna móra ag baint leis an rang talṁaíoċta. Córas éifeaċtaṁail oideaċais is eaḋ é, gan a ḃeiṫ costasaċ. Má's mian linn coiméad ar cóiṁ-ċéim le forḟás na talṁaíoċta i dtíorṫaiḃ eile ní fearr dúinn-ne rud a ḋéanfaimís ná an gléas seo oideaċais d'feaḃsú agus d'fairsingiú cóṁ mór agus is féidir é san am atá le teaċt.

TRIALS ON THE GROWING OF LUCERNE AT THE DEPARTMENT'S FARMS.

Trials in connection with the cultivation of lucerne were initiated at the Agricultural Schools at Athenry, Ballyhaise, and Clonakilty in 1940 on clean well-drained soils. Any deficiency in the lime content of the soils was corrected by the application of suitable dressings during the cultivation previous to sowing. At all centres the seed was sown in rows 25 inches apart on a fine firm seed bed at the rate of 25 lb. per statute acre. Details regarding the establishment, persistence and yield of the crop at each centre are as follows :—

ATHENRY CENTRE.

A plot of lucerne, one-eighth of an acre in area, was sown in June, 1940. It made good progress from the time of sowing and by the autumn of 1941 was well established.

Three cuttings were obtained in 1941, the total calculated yield of green material being 13 tons 17 cwts. per statute acre. Some of this material was fed green to stock, but the bulk of it was ensiled.

The plot continued to grow vigorously during the 1942 season. Three cuttings which yielded 16 tons per statute acre, were taken, the total produce being ensiled.

In 1943, although the crop was still very well rooted, some of the plants had died off and the plot had become somewhat patchy. It was twice mown for silage, the total yield per acre being 3 tons 6 cwts. There were practically no nodules present on the roots of the plants.

In 1944 the lucerne was grazed heavily by both cattle and sheep. The plot became even more patchy during the summer than in 1943 and by the end of the grazing season the lucerne plants appeared to have died out completely. No manures were applied to the plot since it was sown.

In Table 1 are shown the dates of cutting and the yields for each of the three years in which the crop was ensiled.

TABLE 1.

Year	Date of Cutting	Yield per Statute Acre	
		Tons	cwts.
1941	11th June	6	7
	5th August	4	8
	8th October	3	2
1942	13th June	8	12
	4th August	4	19
	5th September	2	9
1943	24th June	1	7
	17th September	1	19

CLONAKILTY CENTRE.

At this centre a plot of lucerne was sown on the 31st of May, 1940, on a sloping, dry, well sheltered field which had been ploughed after the grass had been cut for silage. Lime at the rate of 30 cwts. and potassic superphosphate at the rate of 4 cwts. per statute acre were worked into the soil previous to sowing. The seed was inoculated with a suitable culture of bacteria before sowing.

The crop was kept clean by hand-hoeing between the rows as required. The lucerne grew well during the season and one cutting which yielded 5 tons 5 cwts. of green material per statute acre was produced in 1940.

By the autumn of 1941 the plants had become well established. No difficulty was experienced in keeping the ground clean. Three cuttings were taken giving a total yield for the season of 10 tons 18 cwts. of green material per statute acre.

The crop continued to make satisfactory progress during 1942. A dressing of liquid manure was applied in spring and the spaces between the rows were hand-hoed to remove weeds. During the summer the ground remained clean between the rows. Three cuttings were taken during the season giving a total yield of 13 tons 14 cwts. per statute acre.

The plot received a light dressing of artificials again in the spring of 1943. Despite successive hoeings a number of weeds such as annual meadow grass and Yorkshire fog continued to grow and the crop became thin and patchy in comparison with previous years. After the first cutting in June, however, it was easier to keep the weeds in check. Three cuttings were obtained during the season the total yield being 10 tons per statute acre.

Early in 1944 it was noticed that about one-half of the lucerne plants had died out. Hoeing was no longer possible as the spaces between the rows became covered with a thick mass of grass especially annual meadow grass and Yorkshire fog. The plants that survived were weak and dwarfed. Growth was late, only one cutting being possible during the season. The long period of drought experienced in the district during late spring and early summer may have been partly responsible for the poor growth, but even when conditions for growth became more favourable the crop did not make much progress.

Each year the produce of the plot was fed in green condition after being cut and it was readily consumed by horses, cows and pigs.

Table 2 gives particulars of the dates of cutting and yields for the years 1940 to 1944 inclusive.

TABLE 2.

Year	Date of Cutting	Yield per Statute Acre	
		Tons	cwts.
1940	End of August	5	5
1941	Mid June	5	6
	Early August	3	15
	Mid September	1	17
1942	June 10th–17th	5	2
	July 27th–Aug. 5th	4	4
	October 10th–17th	4	8
1943	June 12th–19th	4	1
	August 6th–12th	3	7
	October 12th–18th	2	12
1944	July	2	10

BALLYHAISE CENTRE.

A plot, $\frac{1}{4}$ statute acre in area, was sown with lucerne seed, previously inoculated with a suitable bacterial culture, in June, 1940, at Ballyhaise, a

dressing of farmyard manure having been ploughed into the ground the previous winter. Four tons of lime per statute acre were applied before sowing.

The crop brairded well, but grew very slowly, the average height of the plants at end of the first season being less than six inches. In the following winter the lucerne failed where the soil was heavy and wet and rabbits ate the remainder to the ground during the spring of 1941.

During the summer of 1941 the lucerne grew very slowly, attaining a height of only 10 to 12 inches at the end of the growing season. No cutting was obtained in either 1940 or 1941.

In June, 1942, the first cutting was taken and the drier part of the plot produced a short thick aftermath which was grazed in the autumn. In the heavier and poorer parts of the plot the lucerne had almost disappeared and was replaced by Yorkshire fog and agrostis. The plot made very poor progress in 1943 when at least half the produce, cut off the better part, was Yorkshire fog and agrostis.

One cutting was taken in 1944, but by this time the greater part of the lucerne had died out and was replaced by weeds—mainly agrostis and Yorkshire fog.

Summary.

The crop at both Athenry and Clonakilty made very satisfactory progress during 1940 and by the autumn of 1941 had become firmly established. It continued to grow vigorously at both centres during 1942, giving fairly heavy yields of green material. In 1943, however, the plants started to die out and the plots became thin and patchy and difficulty was experienced in keeping them clean. The yields at both centres were considerably reduced compared with the previous season. At Clonakilty in 1944 about one-half of the lucerne plants failed to grow and the ground became very dirty. At Athenry the plot was grazed during the summer of 1944. This probably accelerated the deterioration which became evident in the previous year and by the end of the season the lucerne plants had died out completely.

At Ballyhaise the lucerne brairded well, but failed completely where the soil was wet and heavy. On the drier part of the plot growth was slow and no cuttings were obtained in 1940 and 1941. In 1942 the crop looked more promising but very little of it survived the winter of 1942-43. The failure of the crop at Ballyhaise was probably due to the heavy, retentive soil being unsuitable for the growth of lucerne.

"FLUE DUST" AS AN AGENT IN THE PRODUCTION OF SUN SCALD ON TOMATO SEEDLINGS.

By

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Injury to tomato foliage and fruit due to bright sunlight is not uncommon on plants grown under glass. It may occur either as sun scald or sun scorch. The former name is that usually given to dead, yellowish-white patches with a thin, dry, paper-like texture which develop between the veins on the laminæ of the leaves or on the fruit. whilst the latter term is applied to the killing and shrivelling up of the tips and margins of the foliage through excessive heat. Sun scald is generally caused by a combination of bright sunlight and the presence of water on the leaf blade, although other factors occasionally give rise to it, such as imperfections in the glass or through a focussing of the sun's rays by an overlap of certain panes of glass. On the other hand, sun scorch most frequently results from intermittent spells of bright sunshine in dull, cloudy weather, or to the too close approach of young succulent foliage to the glass.

Sun scald on tomato seedlings is a type of injury which may be considered rare in Ireland. At any rate, this is the first occasion on which such damaged plants have been examined by the Division of Plant Pathology, and as the conditions involved in its occurrence were rather unusual a short account of it may be of interest to growers.

Occurrence and Description of the Injury. In the first week of March, 1944, a commercial grower sent in a box of tomato seedlings for examination and advice as to what was thought to be a bad outbreak of damping-off, which indeed it resembled to some extent. Bare patches occurred in the box due to the collapse of the seedlings at soil level, as in Fig. 1. Although many of the fallen plants had their stems badly constricted, Fig 3, there was no darkening or water-soaked appearance of their tissues as normally occurs in damping-off, and no parasitic organism was present. When such plants were placed in a moist chamber new roots developed freely from above the constricted part, Fig. 4. In addition to these prostrate plants, other neighbouring seedlings showed a white mark or blotch on their stems a little distance above soil level. Practically all these pale areas occurred on the same side of the stems, and they differed in size from a mere speck just visible to the naked eye to

elongated lesions as in Fig. 2, and which occasionally encircled the stem. It was seen from microscopical sections taken through these pale spots, that internal injury to the cells varied in proportion to the extent of the external markings. In those least affected a few of the cortical cells had collapsed, in some cases only 3-4 of the outermost layer being injured. Where lesions were larger the number of damaged cells increased, both around the circumference of the stem and in depth of penetration, until in those badly constricted the whole cortex had been killed from the outside in. Thirty boxes of seedlings (which comprised the entire sowing) were all affected more or less in the same way.

The compost used in the boxes was very dark and fine on its surface. Both these factors were the result of mixing "flue dust" (a by-product from cement works) with the soil previous to sowing. For a number of years past some growers have been in the habit of mixing this substance with the compost used for raising tomato seedlings, in the belief that it prevents damping-off. After the "flue dust" is received from the cement works it is left in a heap outside and exposed to weathering before being utilized. This was the first occasion however, on which any injurious effects were noticed following its use.

In appearance the "flue dust" resembles soot to some extent but is neither so black in colour nor so very fine.

TABLE

Analysis of Cement Flue Dust

Moisture	24.8
Insoluble Siliceous Material	51.0
Nitrogen (organic)	0.2
Potash (K_2O)	0.26
Phosphoric Acid (P_2O_5) insoluble ..	0.22
,, ,, ,, citric soluble a trace.	

In addition to compounds of calcium, magnesium, and iron, there were traces of manganese and boron, and a small amount of sulphide was also present.

I am indebted to Mr. G. O'Sullivan, Lecturer in Agricultural Chemistry, University College, for making the above analysis.

It will be seen from the analysis that while the manurial value of this particular sample was negligible, the only chemical substance present which could be considered detrimental to plant growth was the sulphide. The amount of this, however, was very small, probably as the result of weathering. Moreover, sulphide damage to plants usually shows up in the foliage.

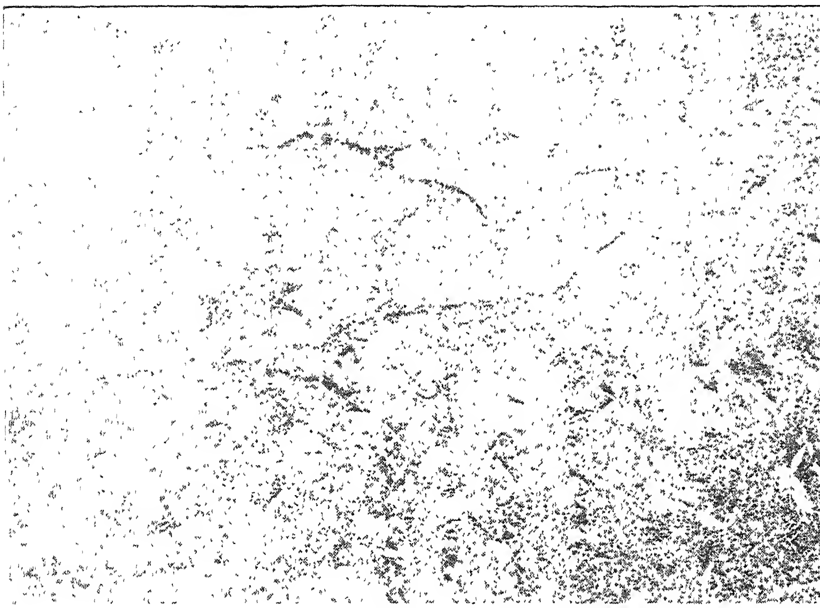

Figure 1.—Box of tomato Seedlings showing collapse of young plants through sun scald. The general appearance resembles damping-off

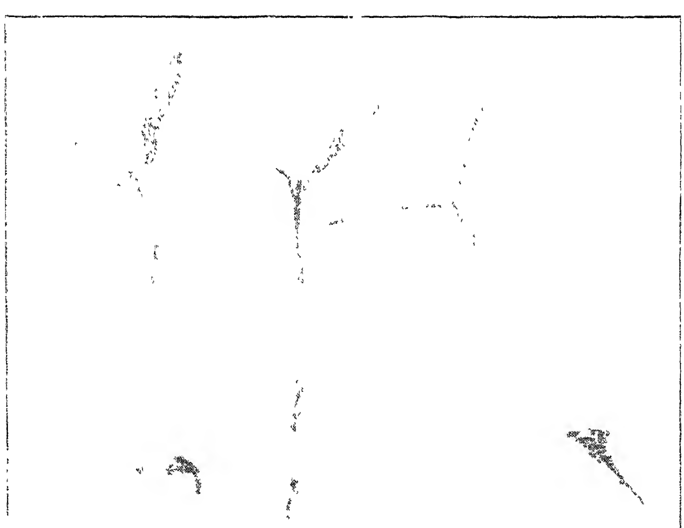

Figure 2.—Tomato Seedlings slightly damaged by sun scald showing white lesion's on their stems.

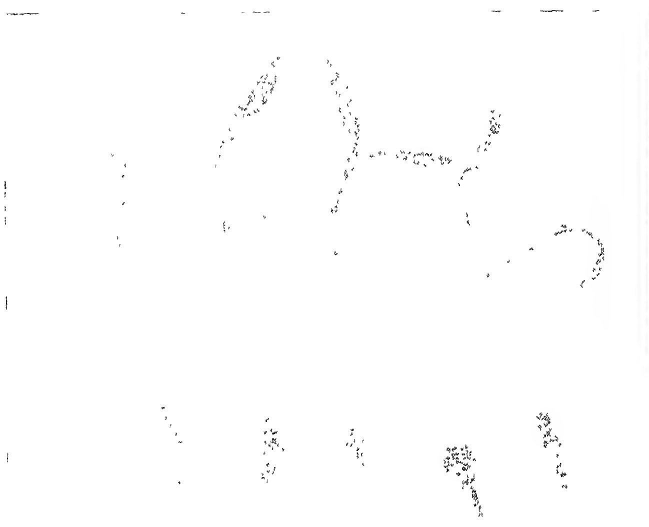

Figure 3.—Severe injury caused by sun scald These plants from affected area of box in Figure 1.

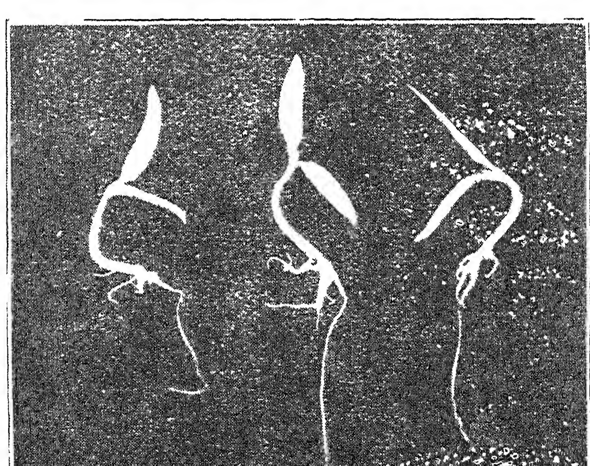

Figure 4.—Badly damaged plants kept in a moist atmosphere at 20°C. showing development of healthy roots above parts constricted and killed by sun scald.

Diagnosis of the Trouble and its Reproduction.—At the time the injury occurred in the spring of 1944, further development of it was prevented by sprinkling a layer of sand over the surface of the soil in the boxes. All the symptoms pointed to the trouble being heat injury, similar to what has already been described in this JOURNAL as "Heat Canker of Flax" (1). At the same time, seeing that it occurred so early in the growing season (the first week in March) when the sun's rays are not particularly strong, it appeared desirable to test the matter out and reproduce the damage in case some unknown factor might be involved. Accordingly, the injury was reproduced several times in September, 1944, and again in March, 1945, by mixing "flue dust" with the compost used for raising tomato seedlings, or by adding a layer of the substance to the surface of seed boxes, and exposing them to direct sunlight in each case. Control plants raised in ordinary compost but lacking "flue dust" and kept under the same conditions were unaffected, as were seedlings raised in compost mixed with "flue dust" but kept shaded from direct sunlight, or kept continuously moist.

Discussion.—Neither a very high temperature in the house nor a long continuous exposure to the sun's rays were necessary for the production of the trouble. Typical heat injury occurred in the susceptible boxes when the temperature of the house was 82°-86°F, and then about two hours exposure to an unclouded sun was sufficient to produce it. This range of temperature is rather too high for tomato seedlings, but it is one which is often reached temporarily in propagating houses early in the season, and tomato seedlings are not injured by such occurrences. During the investigations it was found that the worst sun scald occurred when the surface layer of the boxes to which "flue dust" was added was allowed to get dry. When this happened, owing to the fineness of the soil it tended to form a crust. It is well known that dark soils readily absorb the sun's rays, and Reddy and Brentzel (2) have pointed out that in the production of heat canker of flax, when a crust forms on the surface of the soil it acts as a conductor of heat to the plants, whereas when the top layer is not compacted, little air pockets about the young stems act as insulators and protect them from injury.

No observations were made as to the effectiveness of the cement "flue dust" on control of damping-off, as this disease did not develop in any of the experimental boxes. It was noted however, that in boxes where this substance was used the seedlings invariably appeared above the soil thirty-six to forty-eight hours earlier than in controls.

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THE QUICK GRADING OF MILK ON THE CREAMERY PLATFORM.

By

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As a result of the coming into operation of the Dairy Produce, Act, 1924, the cans used for delivering milk at the creamery are usually suitable for the carriage of milk; so that the examination of the cans means looking for the presence of slime on the inside of the can both before and after the milk is emptied into the weighing vat. In skilled hands this examination is useful and if the suppliers note that it is done regularly, they are more particular about the cleansing of the cans. It is the faulty cleansing of cans on the farm and the lack of cooling facilities that is largely responsible for so much of the milk delivered at the creameries being unsuitable for either the liquid milk trade, or for cheesemaking.

Flavour and aroma are crude tests for grading milk, but if regularly practised, they enable the grader to reject milk that is unsuitable for any creamery purpose. Generally speaking, milk that has developed an acidity of 0.23 per cent. lactic acid can be detected by tasting, and usually milk with an acidity of 0.28 per cent. lactic acid or over coagulates when heated to boiling temperature.

Acidity is a useful quick-grading test, but it has its limitations, the test does not measure the actual amount of lactic acid developed in the milk —which is what is required. The titratable value of fresh milk which can vary from 0.13 to 0.22 per cent. measured as lactic acid, is related to the protein, phosphate and calcium content of the milk, and thus bears a relation to the solids-not-fat content of the milk. This makes it difficult to lay down an acidity standard for creamery milk, but experience has shown that bulk milk of good quality delivered at the creamery seldom has an acidity exceeding 0.18 per cent. expressed as lactic acid.

The dirt test is valuable as an indication of production methods on the farm, if the milk has not been strained, but as most suppliers strain their milk before delivery at the creamery, the dirt pad is not a good guide to milk quality.

The Reductase (methylene-blue) test has proved a valuable test for the grading of milk on the creamery platform. The test is based on the fact that the colour imparted to milk by the addition of a small amount of methylene-blue disappears more or less quickly, the rate being dependent upon the amount of the enzyme, reductase, contained in the milk. The reduction time, whilst it has proved a good guide in actual practice on the creamery platform, indicates only in a general way, the number of bacteria in the milk due to the variation in the reducing power of different types of bacteria, and their ability to grow at 37°C. the incubation temperature used. The procedure is to add to a quantity of milk (40 ml.) such an amount of a solution of methylene-blue that there is one part of methylene-blue to 273,000 parts of the mixture of milk and dye. The milk is then incubated at 37°C. and the time taken for the sample of milk to decolorise noted. By this test milk is divided into the following grades :—

Grade 1. Good milk, not decolorised in 5½ hours, containing as a rule, less than 500,000 micro-organisms per ml. This milk is suitable for all creamery purposes.

Grade 2. Milk of fair average quality, decolourised in less than 5½ hours, but not decolourised in 2 hours, containing, as a rule, 500,000 to 4,000,000 micro-organisms per ml. This milk is suitable for cheese-making and butter-making.

Grade 3. Poor milk, decolourised in less than 2 hours, but not decolourised in 20 minutes, containing, as a rule, 4 to 20,000,000 micro-organisms per ml. This milk is suitable for butter-making.

Grade 4. Reject milk, decolourised in 20 minutes or less, containing, as a rule, over 20,000,000 micro-organisms per ml. This milk is unsuitable for creamery purposes.

A disadvantage of the Reductase test is that it takes several hours to determine if a given milk supply is suitable for cheese-making purposes or for liquid milk consumption ; and about 1931 it was suggested that a dye named resazurin could be used for the grading of milk. The value of this dye has been extensively investigated since, and in many countries it is replacing the methylene-blue test for the grading of milk.

Resazurin is a dyestuff prepared by the action of nitric acid containing nitrous acid on resorcinol. It is very necessary that the resazurin be of good quality or that standard tablets be used. When a dilute solution of resazurin is added to milk and the milk incubated at 37°C. the blue colour changes from blue through lilac to pink and pink to colourless with intervening shades. To standardise the test a comparator is used. The standard disc contains seven empirical colour standards, covering the variations in colour from

blue to colourless. The resazurin test was used in England first as a one-hour test and later as a ten-minutes test, and the milk graded as :—

Disc No. after 1 hour at 37°C.	Bacteriological Quality (average condition)
6	Excellent
5	Very Good
4	Good
3	Fair
2	Poor
1	Bad
0	Very Bad

This one-hour resazurin test gave good results when used by us for grading milk received at the Creamery, University College, Cork ; but it was found that it was advisable to shorten the time for the test even if the results were not as reliable, so as to make it a practicable test for use on the creamery platform. It having come to our attention about three years (1) ago that it had been recommended to shorten the time to ten minutes, in the summer months of 1943, 1944 and 1945, with the assistance of my assistant—Mr. T. O'Mullane, M.Sc. (Dy.) and the senior students, a number of milks were graded comparing the methylene-blue test and the ten-minute resazurin test on the same sample. The test was carried out as it would be on any Irish creamery platform. When all the cans of milk belonging to a supplier had been poured into the weighing machine, a sterile tube having a mark at 40 ml. was filled up to the mark with the milk dipped up by a dipper that was rinsed in the milk and used for each supplier's milk. With a 10 ml. pipette, that was rinsed in the milk and used also for each suppliers' milk, 10 ml. was delivered into a sterile test-tube 6″ x $\frac{5}{8}$″.

To the 40 ml. of milk was added one ml. of a 0.002 per cent. methylene-blue solution, the test-tube was stoppered with a rubber stopper, mixed gently and incubated at 37°C. The time taken for the milk to decolourise was noted. To the 10 ml. of milk was added one ml. of 0.005 per cent. resazurin solution, the contents mixed and incubated at 37°C. for ten minutes and the disc reading taken, or the colour noted. Where the colour was noted, it was found possible to divide the reduction into four stages without serious error, blue, lilac, pink and white.

Grade	Disc Reading	Colour	Milk Quality
1	5 and 6	Blue	Good
2	4	Lilac	Fair
3	1, 2 and 3	Lilac Pink to Pink	Poor
4	0	White	Reject

A total of 651 milk samples were graded by the resazurin test and the methylene-blue (reductase) test. Many of these samples represented a mixture of morning's milk and the previous evening's milk in varying proportions, and the tests were carried out as far as possible as they would be on a creamery platform. The methylene-blue tubes were incubated in a copper bath, the temperature of which was held between 95° F. and 100°F. during the experiment by the addition of hot water. The resazurin tubes were held in a jug containing water kept as near as possible at 98°F. In every case light was excluded, except while taking readings and the methylene-blue tubes were inverted at twenty minutes and at about one hour after commencement of test.

Table 1 gives the grading of the milk samples using the resazurin test. Table 2 gives the grading of the same samples using the methylene-blue (reductase) test. As under regulations made under the provisions of the Milk and Dairies Act, 1935, it has been laid down for the grading of standard milk that the milk when tested must not decolourise the methylene-blue within four-and-a-half hours if the sample is taken at any time from the first day of May to the thirty-first of October, it was deemed advisable to grade the Methylene-blue results as given in Table 2.

TABLE 1.

RESAZURIN TEST.

Disc No.	Colour	Number of Samples	per cent.	Grade
6 and 5	Blue	477	73.3	Good
4	Lilac	66	10.1	Fair
3, 2 and 1	Pink (varying shades)	71	10.9	Poor
0	White	37	5.7	Reject
	TOTAL:	651		

TABLE 2.

METHYLENE-BLUE (REDUCTASE) TEST

Time (hours)	Number of Samples	per cent.	Grade
Over $5\frac{1}{2}$	184 } 285	28.3 } 43.9	Excellent
$4\frac{1}{2}$ to $5\frac{1}{2}$	101	15.6	Good
2 to $4\frac{1}{2}$	165	25.4	Fair
$\frac{1}{2}$ to 2	133	20.3	Poor
Less than $\frac{1}{2}$	68	10.4	Reject
TOTAL:	651		

TABLE 3.

Disc No.	Colour	Grade	Methylene-Blue Test (hours)				
			Over $5\frac{1}{2}$ per cent.	$4\frac{1}{2}$ to $5\frac{1}{2}$ per cent.	2 to $4\frac{1}{2}$ per cent.	$\frac{1}{2}$ to 2 per cent.	Less than $\frac{1}{2}$ per cent.
6 and 5	Blue	Good	38.6	20.4	32.0	9.0	0
4	Lilac	Fair	0	6.0	18.2	75.8	0
3, 2 and 1	Pink (varying shades)	Poor	0	0	0	56.3	43.7
0	White	Reject	0	0	0	0	100.0

A comparison of Tables 1 and 2 makes it clear that the methylene-blue test is a severer grading test than the ten minutes resazurin test. This is made more evident in Table 3. This Table shows that, classifying all samples of milk that did not decolourise the methylene-blue in four-and-a-half hours or over in one grade, that of the total number of samples classed as good by the resazurin test, only 59 per cent. were placed in the same grade using the methylene-blue test, 32 per cent. were graded as fair and 9 per cent. as poor.

Of the milk samples classed as fair by the ten minutes resazurin test, 18.2 per cent. of these were placed in the same grade as good and 75.8 per cent as poor. Of the milk samples classed as poor by the ten minutes resazurin test, the methylene-blue test placed 56.8 per cent. in the same category and classed 43.7 per cent. as poor. With regard to milk samples placed in the reject class there is a correlation of 100 per cent. between the two grading methods.

CONCLUSION.

The ten minutes resazurin test is recommended as a useful test to use on the creamery platform for the selection of milk suitable for the liquid milk trade and for cheese-making purposes. In using this test any sample of milk that does not show a change of colour in ten minutes is suitable for above purposes.

REFERENCE.

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WILD WHITE CLOVER.

By

H. A. Lafferty, D.Sc., F.R.C.Sc.I.

Wild White Clover (*Trifolium repens var. sylvestre*) the popularly accepted 'shamroge'' or Shamrock is indigenous to this country and appears as a volunteer plant in varying degrees of profusion in pastures, roadsides and on derelict sites of old buildings, but contrary to uninformed belief it is also a native of Europe, Asia, Africa, North and South America, and is a comparatively recent introduction into Australia and New Zealand. Legendary records refer to it as a prominent feature of pastoral Ireland in pre-Christian times but the first authentic reference to it as a plant of agricultural importance appears to have been made in 1631, when it was identified as a valuable constituent of pastures in Kent.

For the next two hundred and fifty years Wild White Clover received no particular attention and it was not until 1886 and the following years that its merit as a pasture plant was finally and firmly established. Up till that time Dutch White Clover, a short-lived strain of the wild variety was in popular demand and when used in seed-mixtures it grew satisfactorily for one or two years and then disappeared. In the absence of creeping grasses, like Rough-stalked Meadow Grass, which rapidly colonize bare patches of ground, the disappearing Dutch White Clover was soon replaced by weeds and such pastures rapidly deteriorated, a feature that was not so noticeable in the case of old pastures which included appreciable amounts of the Wild White variety among the herbage.

Farmers eventually realised the importance of this indigenous strain of clover and later its merits were placed beyond doubt by the experiments of Gilchrist. Using the crude harvesting and cleaning machinery available at the time, seed of Wild White Clover was saved from old pastures in Kent and elsewhere and used in grass seed-mixtures. The results were striking, a new forage plant had arrived, and in 1905 its seed appeared for the first time in a trade catalogue, the price being 1/6 per lb. However, the supply was not able to meet the demand and values soared until 1920, when the entire stock of English-grown Wild White Clover seed was cleared at 35/- per lb.

Before dealing with the characteristics of this plant it must be emphasized that the term "Wild White Clover" as generally understood, implies not a single pure and fixed variety, but a mixture of strains, some of which become

dominant when growing naturally under a particular set of conditions, especially those connected with climate, soil, and competition; but should any or all of these variable factors become radically altered, the original dominant strain or strains may be superseded by others from the mass culture that are better adapted to the new conditions. For instance, old English strains of this clover were originally introduced into New Zealand but owing to the altered environment under which the plants were grown there a new type was evolved which, though it suited local conditions, proved to be less persistent than the original when brought back and grown under English conditions. Similarly in Sweden where the climate varies considerably from North to South, it was not possible to produce a single strain of Wild White Clover that would succeed under all conditions and the problem was only solved when three local strains were developed to suit the Northern, Middle, and Southern regions, respectively. In this country we are fortunate in that Kentish and other local English strains have given complete satisfaction where cultural and other conditions have been reasonably good, but there is no reason to believe that a development of one or more of our native strains of Wild White Clover would not give even better results.

With regard to the general form of the plant it is sufficient to say that in its young stage it produces a tap-root and a main stem from which stolons radiate and creep along the surface of the ground. From the nodes or joints of these creeping stolons secondary roots arise which give the plant a new lease of life and encourage its further spread. In this way a single Wild White Clover plant will cover a very considerable area in a comparatively short time. These stolons also serve as storage organs for food and water and in this way they enable the plant to commence growth in early summer even after prolonged periods of drought. This adaption was particularly emphasised in the summers of 1938 and 1939 when Wild White Clover made its appearance in unprecedented amounts in pastures throughout the country. In both these years an abundance of spring grass seemed to be assured and cattle were turned out, but a long spell of drought set in, the early promise was not realised and pastures were eaten bare by the month of June. These conditions rather favoured the Wild White Clover, where present, and even in the absence of rain it grew and spread in pastures where it had not been noticed in appreciable amounts beforehand.

The leaves arise mainly from the creeping stolons and the length of the leaf-stalk depends to a large extent on the habitat in which the plant is growing. In exposed or well-grazed sites the leaf-stalks are short and the plant assumes a low-growing rosette form, but in dense or long herbage the petioles become elongated in an effort to carry the leaves up to the light. The leaves may be uniformly green, but in the majority of plants characteristic white marks are usually visible. The extent and shape of these marks varies with the individual plant but all leaves of a particular plant have more or less the same leaf pattern. The inflorescence, or what is popularly called the flower, is

spherical in shape and white or pinkish-white in colour, and is borne on a stalk, which like the leaf-stalk, may vary considerably in length. The individual flowers which make up the inflorescence are almost completely self-sterile, consequently they cannot produce seed unless cross-fertilization takes place and this is brought about by the agency of bees when they visit the flowers in search of nectar.

The seeds are produced in minute pods and are roughly triangular or heart-shaped, yellow or yellowish-green in colour and of such a size that it takes approximately half a million of them to weigh one pound. The germination of the seeds of this plant presents some peculiarities which are interesting not only from a scientific point of view but also from the practical aspect of field establishment. In almost every sample undergoing a germination test in the laboratory a number of seeds are found which, though alive, cannot absorb moisture owing to the impermeable nature of their seed coats and are therefore unable to germinate even when kept for ten years under conditions normally suitable for germination. Such seeds are known as "hard" seeds and in extreme cases they may amount to as much as 40 per cent. of the total. Since official germination reports in such cases record the actual percentage of germination, which is as a rule relatively low, together with the high percentage of "hard" seeds present, some farmers have an objection to using seed of this quality in their seed mixtures, an objection that is not necessarily based on sound principles, but to get over this difficulty most commercial seed-cleaners include in their equipment a machine for scarifying or "softening" such seeds so as to enable them to germinate normally.

The germination of seed, like that of Red Clover, should be uniform and rapid if the plant is to produce its greatest bulk in the hay crop some fifteen months after sowing, and it follows that in such circumstances a high content of "hard" seeds would be a decided disadvantage since some of these might not germinate for a considerable period after they were sown. In the case of Wild White Clover however, such rapid germination in the soil is not essential since the plant does not and is not expected to contribute to the first year's hay crop. In fact, where germination is rapid the young clover seedlings have in the first instance to face the danger of being smothered in the nurse crop, which is usually a cereal, while those that survive the following winter have then to meet the smothering effect of the hay. In other words for some fifteen months the young Wild White Clover seedlings have to fight what is often a losing battle against great odds and it is here that the samples with a high percentage of "hard" seeds come into their own. These seeds, or at least some of them, lie dormant in the ground for a shorter or longer period but when they do eventually germinate the danger period is over and the young seedlings are able to hold their own with the pasture grasses among which they now find themselves. On that account—other things being equal—a natural sample of Wild White Clover with a laboratory germination of, say, 60 per cent. and containing 30 per cent. of "hard" seeds would appear to be preferable for

inclusion in a grass seed-mixture to a scarified lot of seed from the same bulk where the germination had been artificially raised to approximately 90 per cent.

While the grass farmer who uses Wild White Clover in his seed-mixtures is primarily concerned with the production of more "grass" the plant has other far-reaching influences which are often overlooked because they are not so self-evident.

In the seventeenth century Malpighi recorded the presence of nodules or minute swellings on the roots of leguminous plants but he had no idea as to how these were formed or what their function was, though about that time agriculturists were beginning to appreciate the fact that clovers and other legumes improved the fertility of the soil. This is clear from a pamphlet written by a farmer in 1732 in which he stated that: "Pulse, peas, and all legumes by sheltering the ground by the broadness of their leaves make it retain the nitre and spirits of the air and thereby enrich it." Though the reasoning was at fault this was an extraordinary forecast of a most important scientific discovery that was not to be made until a century-and-a-half later when Hellriegel, in 1886, proved that the nodules on the roots of clovers and other legumes were due to bacterial infection and that the bacteria within the nodules were able to fix atmospheric nitrogen and pass it on to the growing plant.

During the fifty-odd years that have elapsed since Hellriegel's time an enormous amount of work has been done on the root-nodule problem, but the whole story is not yet told. Rapid advances in our knowledge have been made within the past two decades, due in the main to the researches of Virtanen and his associates who have shown that the nodule bacteria in the presence of carbon do fix atmosphere nitrogen, of which the air contains some 80 per cent., and that some of the nitrogen compounds so formed are passed on to the growing plant. These workers also proved, and this is most important, that where these nitrogenous compounds are produced in quantities in excess of the host plant's requirements, as they usually are, the surplus is excreted into the soil, where it may be stored or alternatively used by non-legumes growing convenient to the nodule-forming plant. In other words Wild White Clover as a constituent of "grass" uses the free nitrogen of the atmosphere to increase to the full its own rate of growth and having achieved this it continues to produce nitrogen compounds which it excretes through its roots into the soil, there to be drawn on by grasses like Perennial Ryegrass and Cocksfoot, growing in association with it.

It often happens in a well-balanced Wild White Clover grass-mixture that nitrogen compounds are excreted into the soil in amounts that are even beyond the capacity of the grasses to use, and in such cases soil fertility is actually being built up as an accompaniment to maximum forage production.

These facts have been borne out by experiment and in this connection it is interesting to record that the first trial to be carried out in this country with Wild White Clover was conducted over thirty years ago by the late Dr. Davidson. It is not necessary to discuss that trial in detail and reference will only be made to the results obtained over one grazing season, which we now know was too early in the life of the pasture to show this clover to the best advantage. The inclusion of the Wild White Clover in the seed-mixture showed in the year under test a grazing profit of £3 10s. 7d. per statute acre over the control plot, and with regard to the lea oats which were eventually grown on the clover plot but which were not weighed, Davidson writes : "The crop presents the same rich, dark green colour as if top-dressed with Nitrate of Soda or Sulphate of Ammonia and shows an increased production of about one-third." Later, in another trial with oats, following a Wild White Clover pasture, it was found that the crop (grain and straw) showed an increased profit of £4 2s. 6d. per acre more than that from the plot which had been sown down without this Clover. Both these results have been confirmed by more elaborate experiments conducted elsewhere but of these only two will be mentioned.

With reference to live-weight increases from temporary lea mixtures with and without Wild White Clover, Roberts reports the results of a grazing trial with sheep and cattle which continued for four years, and at the same time he compared live-weight production from a temporary lea containing Wild White Clover with that from a good permanent pasture. The results as summarised by Roberts are as follows :—

(1) The plot in which Wild White Clover was sown gave 25 per cent. more live-weight increase than that from which it was omitted.

(2) During the four grazing years the temporary pasture with Wild White Clover gave 40 per cent. more live-weight increase than the permanent pasture.

(3) The superior live-weight increase from the Wild White plot was due to its greater stock carrying capacity.

So much for the grazing animal and its live-weight increase. Turning in more detail to the question of accumulated soil fertility as revealed by increased crop returns and soil analysis, reference will be made to another trial carried out in this country over twenty years ago where a field that had been laid down to grass for six years, in plots with and without Wild White Clover, was eventually broken up and sown with a crop of oats which produced the following yields :—

	Grain per Stat. Acre.	Straw per Stat. Acre
Wild White Clover plot ..	$28\frac{1}{2}$ cwts.	$40\frac{3}{4}$ cwts.
Control plot (No White Clover)	21 „	30 „

In other words the inclusion of Wild White Clover is the seed-mixture resulted in an increase of $7\frac{1}{2}$ cwts. of grain and $10\frac{3}{4}$ cwts. in the straw of the following oat crop. Furthermore, after the crop of oats had been removed the soil of both plots was analysed and it was found that the soil of the Wild White Clover Plot contained a quantity of nitrogen equivalent to 25 cwts. of Sulphate of Ammonia per acre more than the control plot, and also an increased amount of organic matter that could only be equalled by an application of approximately 20 tons of dung per acre. The latter part of the experiment suggests that the accumulation of combined atmospheric nitrogen in fertile soil where Wild White Clover has been included in the seed-mixture amounts on an average to the equivalent of approximately 4 cwts. of Sulphate of Ammonia per acre per annum, a figure which has, for all practical purposes, been independently confirmed.

It would appear that the total amount of Wild White Clover seed used in this country annually amounts to something in the nature of 10 tons which at a minimum rate of sowing of, say, half-a-pound per statute acre, represents the laying down of about 45,000 acres of permanent and temporary lea with seed of this clover. Statistics show that approximately 300,000 acres are laid down annually for first crop hay and while all this may not be intended for hay plus grazing it would probably not be an over-estimate to assume that at least 250,000 acres of this is grazed for some years after the hay crop. From this it is clear that over 200,000 acres are laid down annually in this country for hay and temporary or permanent grazing where no Wild White Clover is used. It is equally clear from the trials reported that this enormous acreage is not producing its maximum in the form of live-stock products during the life time of the pasture and to keep it in partial production requires in normal times the application among other things of nitrogenous fertilizers which could largely be dispensed with for that purpose if Wild White Clover and the root-nodule bacteria were exploited to the full.

Until recent years Wild White Clover was regarded as a plant that would only grow in the presence of lime, or in other words on neutral or alkaline soil, but investigations both here and elsewhere have shown that it can at least maintain a footing on soils that are distinctly acid and it has been found growing, though not luxuriantly, on soils with a pH value as low as 5. Soils of this nature are, however, much too sour for the maximum production of most agricultural crops, and if they were limed to reduce acidity they would undoubtedly produce better crops generally and better pastures in particular. Third-rate grasses like Fiorin would be reduced and Wild White Clover, where present, would develop and spread under the improved conditions. This was clearly proved by trials where the application of lime alone to a poor pasture reduced the bent-grasses from 43 per cent. to 8 per cent. after four years, and during that time the clover increased from a mere trace to over 10 per cent. of the total herbage. The Bent-grasses were replaced by

Crested Dogstail and a comparatively useless pasture was converted into good sheep-grazing by lime alone.

This affinity for lime is shown by the fact that Wild White Clover contains about 3 per cent. of Calcium or almost three times the amount present in grasses like Perennial Ryegrass and Cocksfoot, and on this account it is a valuable constituent of pastures for young stock which demand large quantities of lime for bone formation, and for dairy cows in full milk. When this high Calcium content is considered in conjunction with its high protein content it is clear that we have an ideal forage plant for every kind of farm stock. In this connection it may be mentioned that not only has Wild White Clover of itself a high protein content but by supplying excreted nitrogen compounds to the associated grasses it in turn enables these to build up more proteins than they would otherwise do if growing alone. It has been shown that Perennial Ryegrass when grown as a pure stand had a protein content of 22.8 per cent. but when grown in association with Wild White Clover this figure was increased to 25 per cent. Furthermore the addition of 2 lbs. of Wild White Clover to a seeding of 24 lbs. of Perennial Ryegrass per acre increased the dry matter of the herbage by approximately 100 per cent. (*i.e.*, 1,678 lbs. to 3,360 lbs. per acre) and the protein content of the mixture was raised to 30.2 per cent. as compared with the figure of 22.8 per cent. for the Perennial when grown alone.

On land intended for temporary pasture the best time to apply lime is in preparation for the root crop, or during the winter preceding the cereal crop. This gives it sufficient time to become thoroughly incorporated with the soil and counteract acid conditions before the grass and clover seeds are sown. It is impossible to lay down hard and fast rules for liming, but except in the case of very acid soils which may require special treatment an application of burnt lime, either slaked or ground, at the rate of one ton per acre, once in every complete rotation, say once in seven years, would generally meet requirements. The form of the lime does not appear to be of great importance and ground limestone at twice the above rate is just as effective as burnt lime and more easily applied.

Next to lime in importance for the growth of clover is the amount of available phosphates in the soil and it might almost be taken as axiomatic that without sufficient phosphates Wild White Clover will not succeed. Here again the form of the phosphoric acid is not of material importance, but Basic Slag, or ground rock phosphate, at rates of 6-8 cwts. per statute acre have on the whole given better results than superphosphates. For some years phosphatic manures have been in short supply or unobtainable, but even when these were available and relatively cheap the amount used generally throughout this country was not sufficient to make up for a normal phosphatic deficiency. This deficiency has now become greatly intensified and when pre-war conditions return and supplies of phosphatic manures are

again on the market the first duty of the Irish farmer should be to ensure that this soil exhaustion that has been going on for years is corrected with the least possible delay.

Wild White Clover when incorporated in a grass and clover seed mixture in amounts varying from one-half to three-quarters of a pound per statute acre produces under favourable conditions a nicely balanced sward that is almost fool-proof if grazed in such a way that the clover is never allowed to get the upper hand, or to exceed about one-third of the bulk of the herbage. This can generally be achieved by intermittent grazing where the developing grasses compete with the clover and keep it in check, but where severe grazing in late spring is practiced, which is so often the case, the early grasses are so weakened that when the clover commences vigorous growth in early summer it runs riot and a lob-sided clover-dominant pasture results, which fails to produce maximum grazing during the rest of the year.

In conclusion, it would appear that :—

(1) The amount of Wild White Clover seed used annually in this country is only about one-fifth of normal requirements.

(2) If included at the rate of even half-a-pound per acre in all seed-mixtures laid down for hay and grazing during the next five years about 1,000,000 acres of Irish grass lands, would by the end of that time, be producing at least 25 per cent. more live-stock products than they are producing at present.

(3) This would be accompanied by an annual increase in soil fertility which, in terms of Sulphate of Ammonia alone, would amount to something in the nature of 200,000 tons.

(4) This extraordinary result could be achieved at a relatively insignificant cost.

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"GID" (COENUROSIS CEREBRALIS).

"Gid," also known as "Sturdy," "Staggers," and "Turnsick," is a disease of ruminants, sheep and cattle being most often affected. It is known in every part of the world. Usually losses from it, though apt to continue yearly on premises where the disease exists, are not very high, but in rainy years the usual enzootic form in sheep may assume an epizootic character with numerous deaths. Severe losses in cattle have occasionally been reported in this country.

Cause: "Gid" is due to the presence in the brain or spinal cord of the larval or bladderworm stage of a tapeworm of the dog called *Tænia Multiceps.* The bladderworm is called *Multiceps Multiceps* and is in the form of a cyst which may vary in size from that of a small pea up to a hen's egg or orange.

Mode of Infection: The adult tapeworm in the intestine of the dog consists of a head or scolex which is affixed to the lining membrane of the bowel by hooks and a body composed of transverse segments or proglottides which grow from the head. These segments form a flat chain, each segment being complete in itself. When ripe, the terminal segments drop off from the body of the tapeworm and are expelled in the droppings. Each segment contains numerous ripe ova or eggs and is easily seen, being about half an inch long and one-fifth inch wide and of a dirty white colour. Those eggs when passed out in the fæces contaminate the pasture or drinking water. The eggs can live for a certain time outside the body, especially in damp weather. When a sheep or bovine animal eats grass or drinks water contaminated by those eggs, they hatch out in the intestine of the sheep or bovine animal, and the young hooked embryos bore their way through the bowel wall. They are then carried by the bloodstream to different parts of the body, but only those that reach the brain or spinal cord survive, the others soon dying. The embryos that reach the brain or spinal cord undergo development into cysts or bladderworms, and are fully grown in from seven to eight months. Those cysts when eaten by a dog develop into adult tapeworms. The carrier of the tapeworm on a farm is usually a sheep-dog which has opportunities for eating the brains of animals that died from "Gid." The disease in sheep and cattle is thus connected with the keeping of dogs on the farm. In wet years the ova have a better chance of survival until being picked up by a suitable host than in dry seasons.

Symptoms: The disease is most prevalent after a wet spring. Young sheep and cattle are most frequently affected. In from one to three weeks after

the ova are swallowed with grass or in water, symptoms of the acute stage when the young embryos are travelling through the brain or spinal cord may be seen. Usually, however, they are so slight as not to be noticed. Exceptionally, if the infection is severe, the animal may die with symptoms of brain trouble, such as stumbling, bending of the head, and convulsions. In mild cases the animal may lag behind the others, appear dull and move stiffly. These mild cases appear to recover in about ten days time, and seem all right for some months. Recovery, however, is only apparent, for while for about six months all symptoms are absent, the cysts are continuing to grow in the brain or spinal cord, and as they grow the pressure they exert gradually causes symptoms of the chronic phase of the disease to appear.

Usually the cysts or bladder-worms are found in the brain. When they are in the spinal cord, gradual paralysis of the limbs, bladder and bowels results, and after a time the animal falls, is unable to get up, and dies.

When the cysts are in the brain, the first of the secondary symptoms indicate impairment of the usual functions of the brain. The animal is dull, lags behind its comrades, may have a staring expression, eats irregularly, or may stand forgetting that it has taken food into its mouth.

As the cysts grow and the pressure on the brain increases, the symptoms of brain disturbance become aggravated. The animal may hold its head to one side and turn in a circle. The head may be held against the chest, pressed against a fence or manger, turned back over the shoulder, or held down on the ground. The sight is often affected. There is salivation and grinding of the teeth. There is loss of balance. The animal may stagger, or lift its legs too highly or turn in smaller and smaller circles until it eventually falls to the ground. It may even walk in a circle of the same size, or one gradually increasing in size until it comes to a standstill, or may move backward, or fall sideways. All those symptoms are intermittent and the animal has restful periods. However, the symptoms gradually grow worse, the animal ceases to drink or eat, and death occurs from emaciation or direct involvement of the brain.

Treatment : There is no drug known which will kill the cysts once they have developed in the brain or cord.

If the cyst is situated on the surface of the brain the pressure causes the overlying bone to become thin, pressure atrophy. The bone may be so thin that it may be perforated by the cyst. Manipulation may detect such an area of softening of the brain, and in such cases an operation may be successfully performed by a veterinary surgeon, the bone being trephined, the cyst or bladderworm removed, the wound in the skin sutured, recovery taking place in a few weeks.

In many cases the cysts are too deeply placed to permit of operation and death ensues.

Prevention: As cattle and sheep are infected by consuming herbage or water contaminated by ova of the dog tapeworm, *Tænia Multiceps*, an essential precaution is the dosing about every three months of all dogs on the farm with a remedy against tapeworms. The dogs should be tied up while being treated, and all worms, droppings, and soiled litter burned or deeply buried. If this is done regularly and the dogs kept free of tapeworms, infection of sheep and cattle will be prevented.

In cases where cattle or sheep die from "Gid," the carcases should be deeply buried so that dogs cannot get at the heads and eat the brains containing the bladderworms. Each cyst or bladderworm has on its inner surface a number of heads, perhaps several hundreds. When the cysts are eaten by a dog each head may grow into an adult tapeworm, which in its turn will produce segments with ova, which when passed out in the fæces will complete the vicious circle by infecting other cattle or sheep.

Prevention thus consists of (1) Periodic treatment of the farm dogs to keep them free from tapeworms and (2) Burying deeply of all carcases of sheep or cattle dead from "Gid," so as to prevent infection of the farm dogs with tapeworm.

MATERIALS FOR AGRICULTURAL STATISTICS PRIOR TO 1847

SURVEY OF PORTNAHINCH BARONY, LAOIGHIS, A.D. 1819, WITH HOLDINGS AND ACREAGES IN SIZE-GROUPS, 1825–1931.

By ROBERT C. SIMINGTON
(Editor, *Civil Survey of Ireland, A.D.* 1654-56).

The importance of the discovery of documents for the determination of the extent of land in tillage and pasture, over specific areas, prior to 1847, when the collection of Agricultural Statistics began, was instanced by the publication in the *Journal* for 1941 of agricultural returns, dated 1834, in respect of six Tipperary parishes.[1] It may be recalled that these returns were drawn from the Tithe Applotment Books, a series of parish records, ranging in date from 1823 to 1837, which came into existence on the enactment of legislation for the establishment of compositions for tithes. The details of the agricultural employment of the land furnished by the Applotment Books of the Tipperary Parishes included particulars of the areas of each holding under the various crops specified. The total area involved represented in statute measure 25,864 acres. Of this, 55 per cent. was shown to have been under tillage and 45 per cent. in pasture; the area of greatest tillage was the parish of Derrygrath where the proportion was 67.73 per cent. It may here be emphasised that the particulars afforded in respect of the Tipperary parishes constituted a notable exception to those recorded in the Tithe Applotment series of documents as a whole. A careful search amongst the thousands of Ms. volumes, forming the collection, has failed to disclose similar returns for any other area. Nevertheless, the information of a uniform nature, furnished by the Applotment Books, provides a valuable source for statistics as to land-holding conditions and areas in size-groups over the period 1823-37. This potentiality will be amplified in the course of the present note, and illustrated for the region presently to be indicated, by the presentation of statistics, specially prepared from the Tithe Applotment documents, by the *Statistics Branch* of the Department of Industry and Commerce.

In the first instance, however, it is desired to call attention to returns assembled in the year 1819 specifying, *inter alia*, the acreable contents of townlands in tillage, "meadow and pasture," the size and number of farms and the number of farmers and labourers, engaged in agriculture, over an area some ten thousand acres greater in extent than that comprehended by the Tipperary parishes. The region, the subject of these returns, was the

1. Vol. XXXVIII. No. 2. pp. 239-343.

barony of Portnahinch, County Laoighis, of which a "Survey and Census" was made by Mr. William Shaw Mason, M.R.I.A., in the year indicated. In a wide measure this document, recently discovered, provided a suitable setting for the study of agricultural conditions represented by the later period of the Tithe Applotment proceedings and, therefore, the same territorial unit, which it represented, was selected for the illustrative statistics above indicated. To the latter will apply, accordingly, all that is set out here by way of introduction to the "Survey and Census" regarding the physical features and boundaries of the terrain, the geology of the district, and nature of the soil.

Before treating of this "Survey and Census," and the conditions under which it was compiled, it is desirable to recall, briefly, the associations of its author with wider enquiries on statistical lines. This, incidentally, will explain the origin of the document immediately under consideration which, for its period, may be said to possess unique features of agricultural statistics. During the early decades of the nineteenth century William Shaw Mason was prominently identified officially and privately, with investigations of a statistical and topographical nature.[2] He is, perhaps, best remembered by his three volumes of Parochial Surveys published in 1814, 1816 and 1819 representing instalments of a work which he had envisaged under the title of *A Statistical Survey or Parochial Account of Ireland;* this project is said to have been inspired by Sir John Sinclair's Survey of Scotland. What was then achieved by Mason was accomplished through the agency of the clergy of the Established Church with whom, by virtue of his position as Secretary of the Board of First Fruits, he was closely associated. A lesser known undertaking by Mason was the collection of returns relative to the condition and produce of the crops throughout Ireland in 1816. An unusually late spring in this year, a summer and autumn excessively wet and cloudy, and a heavy rain-fall, believed at the time to have been unprecedented, led to fears of a famine.[3] There was not then available any official organisation for ascertaining the actual condition of the harvest, and Mason again utilised his relations with the clergy to procure the required returns. These were transferred[4] in 1895 from the Record Tower in Dublin Castle to the Public Records Office, Four Courts, where they perished, it is believed, in 1922. Mr. Mason's services had previously been availed of by Government for the purpose of initiating the proceedings for the taking of the first official Census of Ireland, authorised in 1812, by the Act 52 Geo. III., c. 133. The failure of this Census, attributed to the inadequacy of the machinery created by the Act, led to a new Population Act passed in 1815 (55 Geo. III, c. 128), the proceedings under which were again, in 1821, superintended by Mason.

2. Born in Dublin, son of Henry Mason, he entered Trinity College in 1791, at the age of 16, taking his B.A. in 1796; the numerous public positions he occupied will be indicated in the course of the present article.

3. Wilde's Report. *Census* of 1851.

4. *28th Report, Dep. Keeper, Public Records* (I) (1896) pp. 8-11.

In reporting[5] in 1896, to the Lord Lieutenant, on the transfer to the Public Records Office of the Census returns made under the former Act, the Deputy Keeper, in the knowledge derived from the relative papers then in his custody, stated: "One great difficulty in securing accurate information about the country was the absence of any general survey, or view of the topography of the country. This Mr. Mason endeavoured to obviate by obtaining from the County Treasurers, lists of the Parishes and Townlands in each Barony." It may be interjected that, for the most part, the only lists then likely to be available were those to be obtained from surveys made, during the seventeenth century, under the Strafford and Commonwealth Governments. Though an Act of 1809 (49 Geo. III, c. 84) had called for the compilation of Tables of denominations of land and their acreable contents, it is not easy now to discover evidence of compliance with this requirement by the local authorities. It is the exception, it may be added, to find more than the boundaries of baronies, and the specification of some place-names, expressed on the Grand Jury maps prepared at this period. "Mr. Mason was anxious," continued the Report of the Deputy Keeper, "to add in several ways to the meagre information obtained by the Census. Among others he conceived, the idea of obtaining some data as to the relative numbers of the principal religious bodies . . ."

These efforts to secure returns in many connections were so frustrated by various obstacles that procedure by computation, over numerous regions of the country, had to be substituted for that of actual enumeration. Undismayed, however, Mason decided to demonstrate what was required and what might be achieved. This next effort is described in the Report already cited :

"Mr. Mason was not satisfied with the imperfect results of these early statistical efforts, and in 1819, with the assistance of some friends, prepared a model Statistical Survey and Census of the barony of Portnahinch, Queen's County. This contains practically all the information contained in the more recent Censuses, with the addition of what is supplied by the modern Agricultural Returns. This work was successfully completed and a copy presented to King George IV on his visit in 1821."

This somewhat exaggerates the range of Mason's Survey which did not include returns of either crops or livestock.

Another copy, inscribed by the author, was presented to the Lord Lieutenant, Earl Talbot. This bound, and printed, copy is preserved in the National Library, Dublin, and constitutes the text from which the sections containing agricultural data has been printed as an appendix to this note ; a photostat, for this purpose, has been kindly furnished by the Director of the National Library.

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5. *conte*, *28th Rep. D.K.*

As may be inferred, Mason's compilation, which bears the imprint, "Dublin, 1821," though printed, was not published.

Including the title-page, which announces a "*Survey, Valuation and Census* of the Barony of Portnahinch compiled in the year 1819," the volume consists of fourteen pages, folio, and is introduced, following the author's dedication to King George IV, by concise descriptions of the situation, extent, divisions, soil and other features of the barony. The contents of the Tables within which the particulars collected were returned, are then specified, the first Table being entitled "Survey and Valuation," the second "Census." Then follow, in these respective classifications, the relevant statistics, the whole specification being concluded by some brief "Observations" of an explanatory nature.

The framework of the returns, indicating the type of information afforded, may be given in the author's own words:

(1) "Survey and Valuation: The first table shows the number of acres in each townland, both by estimation and according to the Down Survey, detailing the quantity under tillage, fallow, meadow and pasture, mountain pasture, woods and plantations, bog and unprofitable; and also the deficiency or excess in the extent of each townland according to the Down Survey as compared with that taken by estimation. It also contains an account of the acreable rent paid (expressed in shillings and pence) and of the estimated value per acre, at the time the survey was made; an account of the local taxes on an average of three years, and of the number and comparative sizes of farms held by individuals residing upon each townland."

(2) "Census." The second table contains an account of the number of inhabitants, classed 1st, according to residences; 2nd, according to ages, on a scale exhibiting the several states of infancy, education, labour, superintendence and imbecility; 3rd, according to sexes; 4th, according to religious persuasions, and 5th, according to occupations.

Uncertified, the returns thus assembled are capable, at this date, of verification in two main connections, namely, the acreable contents of the barony and the number of farms in size-groups. Pending explanations, in due course, under these heads, the conjoint figures of the "Survey and Census" present in a microscopic, or one might say, intimate manner a view of the mode of life, and means of subsistence, of the inhabitants of the barony of Portnahinch over a century and a quarter ago. Here the "townland" is seen to constitute the unit of many trades and industries, besides that of agriculture, and where enumeration, in these connections, is concerned as to farmers, weavers, masons, carpenters and a dozen other occupations, accuracy is to be presumed. In later official Censuses many particulars had, necessarily, to be given on a county basis, but in this Return the represented facts may

be perceived at the closest possible quarters for which it it was then possible to assemble statistics. Such particulars will be read in the knowledge that, at the date of their collection, Ireland, as a whole, was still suffering from the want of industries capable of absorbing the amount of labour that was available, as well as from the depression incident to the fall in prices which had followed on the conclusion of the European war, some four years previously. Indeed, the year of Mason's "Survey and Census" was also the year which saw the publication of the *Second Report* from the Select Committee appointed to enquire into the State of Ireland with particular reference to the conditions of the Labouring Poor.[6] "The general distress and deficiency of employment are so notorious," states the Report, "as to render it unnecessary for Your Committee to encumber their Appendix with particular evidence to establish the extent and variety of the evil." To relieve this situation, the drainage and reclamation of bogs, concerning which already there had been four Reports, the making of roads, and the development of the fisheries, were recommended.

While the "Survey and Census" of Portnahinch barony purports to be a full return of the facts, represented under the various headings, the Abstract that is published here, as an Appendix, is presented in the character of an excerpt from a historical document, representing, what is believed to have been, the first serious effort in this country, to collect agricultural statistics on scientific lines, rather than as from a duly certified or testified return. The Abstract forming Appendix A (p.284) consists of the following items. (1) "Names of Townlands and other sub-divisions," (2) the "estimated" acreable contents of each such townland in tillage, fallow, meadow and pasture, woods and bog, (3) the actual rent paid per acre and (4) the number of farmers and labourers on each townland, this last being the only item reproduced from the "Census." The returns omitted from the "Survey and Valuation" are those in respect of the names of the proprietors in fee, the particulars of the Down Survey areas, the number of farms in size-groups—to both of which latter further reference will be made, the estimated rents which, it had been considered, should be paid per acre, and the details of local taxes, this last particular being capable of explanation in the course of this note.

The text does not indicate why Portnahinch barony was specially selected for the purpose of this "Survey and Census" "intended as a model for a Royal Statistical Survey of Ireland." There were then available to Mason the Dublin Society's *Statistical Surveys* of twenty-three counties including that of "Queen's." He had the advantage, furthermore, of a considerable number of parochial surveys, which he, himself, had collected through the agency, as already indicated, of the clergy of the Established Church. These, indeed, included an account of the Parish of Lea which represented in extent a little more than half the barony of Portnahinch.[7] The fact, however, may be re-

6. *Second Report* "On State of Disease and Conditions of Labouring Poor in Ireland." June, 1819.

7. See Vol. 1 of *A Statistical Account or Parochial Survey of Ireland*. p. 515. Dublin 1814.

called that the first of the county volumes, published under the direction of the Dublin Society was for "Queen's County."[8] It may be that the reason which inspired the Dublin Society in selecting this county as the starting-point of its great undertaking, similarly decided Mason's choice. That there was some outstanding consideration in selecting out of 300 or more baronies that of Portnahinch, there can be little doubt; perhaps there was found to exist here, as would, indeed, appear to have been the case, a happy combination of circumstances in the disposition, and number of the inhabitants, and in the size and general configuration of this territorial division which may now, briefly, be noticed.

Located in the north-east of Laoighis county, the barony of Portnahinch is wholly bounded on the north and east by the river Barrow which separates it from the counties of Offaly and Kildare respectively; the adjoining barony of Tinnahinch, then containing the greater part of the town of Mountmellick, forms the western boundary, while on the south lie the baronies of Maryboro' containing the Great Heath of that name, and Stradbally. Some twelve by seven English miles in greatest length and breadth, the superficial area of the barony represented 35,835 statute acres as originally admeasured on the Ordnance Survey maps.[9] With the adjacent barony of Upper Philipstown, in Offaly, immediately north of the Barrow, it was co-extensive in former times with the territory of Clan-mail-úgra, now Clanmaliere, of which the O'Dempseys were lords and rulers.[10] Midway in this territory, south of the Barrow, stood the castle of Lea, built, *circa* 1260, as a defence of the Pale.[11] The battles for its possession throughout many centuries indicate this region to have been the locality of a particularly stirring history. This castle was protected on one side by the Barrow which supplied with water a wide ditch that extended round the other sides; the mount on which it was built, being thus formed into an island, was called Port-na-hinch (Port-na-hinse) or the castle of the island. Hence, it has been stated, arose[12] the origin of the name[13] of one of the two baronies into which the territory of Clanmaliere was extended subsequent to the delimitation of the boundaries of the King's and Queen's counties.[14]

8. *General View of the Agriculture and Manufactures of the Queen's County* . . . by Sir Charles Coote, Dublin, 1801.

9. The townland divisions of the barony are expressed on the six-inch maps of Laoighis County, numbered 4 and 5, 7 to 9, and 13 and 14.

10. *Onomasticon Goedelicum*, Hogan. "The O'Dempsey's (Ó Díomasaiġ) who are of the same stock as the O'Connors of Offaly derive their descent from Ros Failghe, eldest son of Cathaoir Mor, King of Ireland in the second century, and were long one of the most powerful families in Leinster . . . Terence O'Dempsey was knighted by Essex in 1599 and in 1631 created Baron of Philipstown and Viscount Clanmalier . . ." Woulfe, Sloinnte Gaeḋeal is Gall—Irish Names and Surnames. Gill, Dublin, 1923.

11. *Dublin Penny Journal*, 1835, p. 293; see also *Collections Diocese of Kildare and Leighlin*, Vol. II, pp. 308-315, Comerford.

12. Vol. 1. *Parochial Surveys*, Mason, p. 548.

13. There is also, however, a townland of this name in the barony.

14. *Fiants* of Elizabeth (No. 6786) 4 November, 1561.

The barony contains the three civil parishes of Lea, Coolbanagher and Ardea, its towns and villages consisting of Portarlington, Emo, Ballybrittas, and formerly a small part of Mountmellick—now within the township of that name. High roads intersected the parishes, providing easy communication alike between the residents and the people of the towns and villages. Portarlington, formerly called Coolterderry, or Cooletedoodra,[15] at a distance of some 45 miles from the metropolis, had the threefold advantage of the Barrow, on which it was situated, the Grand Canal and the high-road from Dublin to Birr; Emo, Ballybrittas and Mountmellick were each served by the high-road from Dublin to Limerick. Whether situated north or south, east or west, the various districts of the barony were easily accessible for business or pleasure no less than scientific enquiry.

The geological features of the barony fall within the "Data and Descriptions" accompanying Quarter Sheet 35 N.E. of the maps of the Geological Survey of Ireland.[16] This quarter sheet includes part of County Kildare with towns of Kildare, Rathangan and Monasterevan occupying its eastern half, while its western portion contains a part of Offaly county to the north, and part of Laoighis with the town of Portarlington to the south:

"The district forms a part of the great central plain of Ireland. It is almost entirely flat, with a general elevation but little more than 200 feet above the sea level. Some small hills south of Portarlington have summits rising to 300 or 400 feet; but the principal hills are in the north-east corner of the map in the little range known as the Chair of Kildare hills. Large portions of the district, both north and south of Monasterevan are covered by peat bog, to the dreary surface of which an agreeable contrast is afforded by the low woody hills about Emo and Ballybrittas on the one hand, and the bright green velvet-like undulations of the Curragh on the other.

"The great plain which spreads over by far the major portions of this map has everywhere a limestone below it, called Carboniferous or Mountain Limestone, either appearing at the surface or concealed by a greater or less thickness of gravel or bog. Some of the hills south of Portarlington are formed of some beds of this limestone higher in the series than those which are to be found elsewhere.

"The entire surface of the country included in this quarter-sheet . . . is covered with limestone pebbles, sand and gravel. The fragments of limestone may, of course, be the debris of the beds immediately below the drift . . . The large tracts occupied by peat-bog and alluvium are, doubtless, covered to a

15. See Parish of Lea. Vol. 1 of Mason's *Parochial Surveys*, *supra*, also *Topographical Dictionary*, Lewis, where it is stated that Portarlington "derived its present appelation from Lord Arlington to whom, with a large extent of country, it was granted by Charles II—and its prefix from a small landing place on river Barrow on which it is situated . . ." The Earl of Arlington, formerly Sir Henry Bennett, was Secretary of State, *temp*. Chas. II.

16. *Geological Survey Memoir*. 1858 (J. B. Jukes).

greater or less thickness with Drift lying between the peat and the rock below. Over these spaces, however, the dotted character for Drift is not extended, because the peat bog here becomes the superior formations. It is sometimes as much as 25 or 30 feet in thickness and crowded occasionally with trunks and roots of trees, the latter always in the position of growth, testifying to the former presence of great forests which spread over the plains."

To the circumstances of a prevailingly flat country, transversed by numerous roads, may be added the further consideration favourable to Mason's project in 1819—excellent weather conditions ;[17] for the same year, an early and plentiful harvest has been recorded.[18] That a spirit of co-operation would exist may be inferred from the fact that the barony was inhabited by "very numerous genteel families," as well as a kindly people whose neat cottages, gardens and orchards were pleasant features of the landscape.[19]

The text does not indicate either the procedure followed, or the sources consulted, in the making of the "Survey and Census." At a later stage of this note these matters will be discussed fully and explained. For the present it is sufficient to say that by virtue of Mason's various appointments,[20] he was well circumstanced to conduct the different enquiries. As Secretary of the Irish Record Commission, a body set up in 1810 to examine into the position regarding the Public Records of the country, old documents of possible use, such as surveys and maps, would or should be well within his knowledge ; as Secretary of the Board of First Fruits, diocesan and parochial archives would be, presumably, at his disposal ; as Superintending Officer of the Population Acts, the papers relative to the Census of 1813 would be under his control ; in this capacity, also, easy access to Grand Jury records is to be presumed. These last would include the Grand Jury map of the county, showing the boundaries of baronies only, made in 1805, by Daniel Cahill, Surveyor and Engineer.

First, may here be given Mason's succint "Observations" on the industries of the barony and on the nature of its soil : "This barony is mostly in a state of agriculture ; the farmers and labourers far exceed in number those of any other occupation : as to other trades or occupations the weavers are the

17. Wilde's Report, *supra.*

18. *Ibid.*

19. *General View of Agriculture . . . in Queen's County*, *supra*, and Vol. 1 of Mason's *Parochial Survey*, parish of Lea.

20. These are specified on the Title-page of the "Survey and Census."

most numerous," the three branches of the industry—woollen, linen and cotton, being well represented.[21]

"The substratum of the soil is limestone, limestone gravel, and in some places a reddish sand with a vegetable covering so light and shallow that it seldom required a plough with more than two horses. About two centuries since, the greater part of this barony was covered with wood,[22] which generally reduces the staple of the soil; and soon after the woods had been cleared away, the grounds were further exhausted by very extensive systems of gravelling."[23]

Summarising the division of the surface of the land by assuming it to be divided into twelve equal parts, Mason gives the following proportions :—

Under Tillage	5
,, Meadow and Pasture ..	5
,, Bog and woods	$1\frac{1}{4}$
,, Unprofitable	$\frac{3}{4}$
	12

The total number of inhabitants of the barony is stated to have been 12,374, representing 2,206 families and "an increase of 470 souls in six years,"

21. The industries for each "Townland" are particularised in the "Census"; here the total may be given in each classification.

Farmers and Labourers	2,260	Saddler and Harness-Makers	9
Weavers	365	Shoe and Brogue Makers	64
Spinners	20	Tailors	36
Woolcombers	6	Mantua Makers	13
Masons	34	Teachers	14
Slaters	9	Servants	191
Carpenters and Wheelwrights	53	Gardeners	20
Sawyers	3	Innkeepers and Publicans	19
Coopers	14	Skinners and Tanners	5
Smiths and Nailers	62		

For Portarlington there are separate returns specifying the number of Clergymen, Physicians, Apothecaries, and so on.

22. As late, indeed, as A.D. 1666, "after the great spoils made" of timber "during the Usurper's time," the Portarlington woods were estimated at 13,000 Irish acres. *State Papers* (I.) 1666-1669, pp. 220-1, and see *State Papers* 1663-1665 for letter from Lord Aungier to Sir Henry Bennett, afterwards Lord Arlington. "How great the advantage will be you will judge when the woods lie for several miles together along the Barrow which is navigable to Ross and Wexford where the chief herring-fishing in this kingdom is and where the best vent for pipe and barrel staves great quantities whereof may be made in the woods of Clanmalira."

23. See The Dublin Society's vol. for Wicklow, by Robert Fraser, for an indication of what is meant by this : "In many instances limestone gravel and marl are used by farmers who have capital and either of those articles contiguous to them. The former I am not acquainted with, but with respect to marl, petty farmers and labourers, who possess horses and cars, engage to dig and lay out marl on a field adjoining the pit for twopence a cartload, the load supposed 6 cwt. From 800 to 1,500 per acre are laid out on old worn-out pasture land, and it is supposed such a manuring with good marl would afford good crops of corn for 10 or 12 or even 15 years successively. This practice, however, is not at all intended to be recommended, the quantity being too great for the working the land gets . . . ." I am indebted to Mr. T. J. Duffy, of the Geological Office, for guidance in this matter.

that is, from the date of the Census of 1813. Each family consisted of from 5 to 6 persons. Farmers and labourers numbered 2,260. The number of houses corresponded with that of the number of families, *viz.*, 2,206.

With regard to the figures furnished in respect of the number of farms in size-groups, these are not quoted here. Either through the loss of slips, or for some other reason, the returns contain inaccuracies which are apparent on the face of the Survey.[24] It may be suggested, however, that the total number given in respect of "Farmers and Labourers," quoted above, is not remote from the total number of holdings in the barony at the date of Mason's Survey. Labourers, it may be added, usually had in this barony, from "half an acre to two and three (Irish) acres with their cabins."[25] Six years later the certified number of holdings in the barony was 2,353.

"The actual rent of the barony," states Mason, "taken according to an average of that of the middling land is 27/– per acre ; the rent which should be paid, if the land were set according to its present actual value, taken according to the same average, may be estimated at 36/– per acre. The whole of the barony is therefore set for 9/– per acre less than its actual value." Actual rents paid per acre in respect of the "best" land are also given in the Abstract forming the Appendix to this note.

"Local Taxes" are distinguished in three classes : County : Parish : Tithe. For the first, indicating Grand Jury Cess, the rate was almost 2/– per acre ; the second, parish cess, was nearly 3d. per acre in Lea parish, and 1½d. in that of Coolbanagher. The charge in respect of tithe ranged from 5d. to 2/10d. per acre.

On the basis of the estimated acreable contents of the parishes and "townlands," excluding areas under bog, woods, and "unprofitable" land, percentages representing acreages under tillage and "meadow and pasture" may now be given. Over the entire barony, tillage represented 48 per cent. and "meadow and pasture" 52 per cent. ; in Lea parish the percentages, in each classification, were almost equal ; in Coolbanagher parish (including that of Ardea), tillage represented 46 per cent. and "meadow and pasture" 54 per cent. Certain "townlands" in both parishes indicate very high tillage percentages : Parish of Lea : Ballymorris, 90 per cent. tillage ; Loughmansland, 77 per cent. tillage ; Cooleterderry (Portarlington) 67 per cent. tillage ;

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24. On the "Townland" of Clonterry, estimated to contain 300 Irish acres, one holding is returned within the group "5 to 10 acres"! The "Census" shows 17 farmers and labourers to have been working on this "Townland." In all groups, it may be mentioned, 1,187 farms were returned for the whole barony. It may be that these figures were obtained from estate rentals showing old leases. Collation with the records of 1825 indicate that in most places, even allowing for extensive sub-division, the number of holdings had been underestimated.

25. This was the explanation given of Con Acre being more prevalent in adjoining baronies than in Portnahinch. There were very few cottiers in the barony when Coote wrote his account published in 1801.

Kilnacourt Upper, 55 per cent. tillage; Ballycarroll, 82 per cent. tillage. Parish of Coolbanagher: Kilmemum (Kilmainham) 75 per cent. tillage; Morett, 61 per cent. tillage; Dangans, 57 per cent. tillage; Coolbanagher, 55 per cent. tillage.

Emo, in the parish of Coolbanagher, represented the greatest "meadow and pasture" unit. where the percentage was 95; Killeen, in the same parish, 80 per cent. "meadow and pasture." Doolagh, in the parish of Lea, 81 per cent.; Graiguevine 61 per cent. "meadow and pasture."

It is to be regretted that Mason's Survey did not include either an account of the crops grown in the barony or particulars of livestock. As to the former, the general harvest in 1819, for the country as a whole, has been recorded "as early and plentiful"—the hay crop as abundant as it had been deficient in the previous year.[26] A mild spring, an uniformly hot summer, suddenly checked in the beginning of September, and an universally severe and early frost in November characterised the year in regard to weather conditions. Statistics as to crops, which would have completed a work so comprehensive in other respects, may not have been available at the precise period when the survey was made. Five years previously, however, in 1814, Mason had published in the first volume of his *Statistical Account of Ireland* a description, having reference to the year 1813, of the parish of Lea. This parish represented 52 per cent. of the total area of Portnahinch Barony and formed its northern section bounded by the river Barrow. The particulars, constituting the account of the parish, were furnished by the Rector—the Reverend J. Jones, and included specifications of the acreable contents under tillage, meadow and pasture; tables are also given of the "Produce of Lands" and of "Live Stock" together with an estimate of the value of "Agriculture." Prevailing prices for wheat, oats, and hay are stated as likewise labourers' wages, the cost of provisions, and the highest rents paid in the barony. Material is thus provided enabling in one or two respects comparison to be made with the position defined six years later.[27]

Describing the parish as within the Bog of Allen—on the edge or outskirts would be, perhaps, its more approximate situation, the reverend author states that within recent years "1,000 acres of improved land had been added from cut away and reclaimed bogs." The mode of agriculture he describes as "planting potatoes for a year or two, then taking a crop of wheat, oats, bere or barley according to the nature of the ground or the will of the owner. If the ground be rank, it may bear a second crop, changing the grain to

26. Wilde's Report, *Census* of 1851.

27. Some items from the "cost of provisions" may here be given :—

Potatoes	from	3½d. to 5d. per stone.	Pork	from	5d. to 6d. per lb.
Oatmeal	,,	2/6 to 3/- ,,	Bacon	,,	10d. to 1/1d. ,,
Beef	,,	4d. to 8d. per lb.	Milk	,,	2d. to 3d. per quart
Mutton	,,	6d. to 8d. ,,	Fowls	,,	1/- to 1/8 per pair
Butter	,,	11d. to 1/8 ,,	Veal	,,	5d. to 8d. per lb.

lighter. The potatoes are put in the ground either by the spade or the plough, but of late, drilling is become more generally prevalent. Horned cattle and sheep are the principal stock, horses being few in comparison."

Wheat is stated to have ranged in price from 35/– to 50/– per barrel, oats from 14/– to 21/– per barrel and hay from £2 10s. 0d. to £3 8s. 3d. per ton.

The parish contained "about 2,500 acres of tillage, 1,000 of meadow and about 3,500 acres in pasture lands." These details are supplemented by the following tables representative of the economy of the parish.

PARISH OF LEA.

PRODUCE OF LANDS			LIVE STOCK										
Species of Corn cultivated	No. of Barrels per acre	Value per acre							£	s.	d.		£
Wheat ..	5	£10 to £12	Horses	from	270	to	300	@	15	0	0	per	3,600
Oats ..	7 to 10	7 ,, 8	Cows	,,	785	,,	800	,,	10	0	0	,,	7,500
Barley and Bere	8 ,, 12	10 ,, 16	Oxen	,,	60	,,	70	,,	17	1	3	,,	1,040
Potatoes	40 ,, 80	15 ,, 25	Sheep	,,	800	,,	1000	,,	1	14	1½	,,	3,600
Flax* ..	15 ,, 20	10 ,, 15	Swine	,,	1,300	,,	1,350	,,	1	2	9	,,	3,975
Hay† ..	6 ,, 12	2 ,, 7										Total ..	£19,720

*Loads at 4½ cwts. †To the Sq. Perch.

A summary table presents the total valuation thus :—

Value of Live Stock ..	..	..	£19,720
Value of Agriculture ..	..	..	31,750
Value of Meadow Ground	..	..	5,118
	TOTAL	..	£56,588

With regard to rents, it is stated that the highest acreable rent of the best land in the parish of Lea, set within the preceding three years (1811-14) was from "£5 to 5 guineas"; that of middling land from "£2 to £3" and that of the poorest from "18/- to 30/-" per acre.

Comparison with the returns made in 1819, by Mason, for the same Parish, show that in the interval the area under tillage had increased by 63.6 per cent.; that the highest rents obtained in respect of the "best" land had

advanced from £5 5s. 0d. per acre to £6 6s. 6d. and similarly with regard to the poorest from £1 10s. 0d. to £2 5s. 6d. In the adjoining parish of Coolbanagher, as will be seen from the Appendix, the highest rent, paid in 1819, in respect of the best land, was £12 per acre. These increases, however, did not connote, an increase in the value either of "Agriculture" or "Live Stock." The fall in prices consequent on the conclusion of a long protracted war had demonstrated the artificial nature of the prosperity which had formerly existed.[28]

It is apposite here to refer to the exceptional position which the international situation, prior to the conclusion of peace in 1815, had created for Ireland as a source of food supplies. This may most briefly and authoritatively be done by a quotation from the *Report of a Select Committee* of the House of Commons appointed in 1812 to inquire, *inter alia*, into the resources of Ireland.[29] The Report, which was printed in 1813, intimates that the answers to queries addressed to the Farming Society of Ireland showed that there had been a considerable increase in tillage, estimated, by "the most skilled persons," at nearly one-fourth within the preceding ten years, but that there were very considerable tracts of land still in grass fit to be converted into tillage.

"Of the actual practicable increase," states the Report, "it is impossible to form any correct opinion, but when all the various circumstances are taken into consideration which exist in Ireland favourable to such an increase, the production of a much greater quantity of corn may be expected than would be sufficient to provide for the average deficiency (calculated upon the importation for the last ten years) of the produce of this country (England) to supply its own wants. The fertility of the soil; the fitness of the climate; the abundance of limestone and limestone gravel; the cheapness of labour; and the general convenience of water carriage together with the progress made in the course of a few years in extending and improving the cultivation of the land form the most complete proof of the ability of Ireland to become entirely serviceable to this country by affording abundance of all kinds of food at moderate prices".[30] It is then shown that the value of Irish corn imported into Great Britain during the preceding five years was more than one-third of the total importation.

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28. The price of wheat for year 1818-1819 was 42/7¼ per barrel and for the year 1819-1820, 34/6¾ per barrel; Oats for the same years were 16/4 and 13/7¾ per barrel—*Dublin Gazette*. See note 30, *infra*, for prices in 1812 and 1813.

29. "Report from the Select Committee appointed to enquire into the Corn Trade of the U.K. and to report their Observations . . ."

30. The Report adds: "The following comparison of the prices of corn in Ireland, coupled with the value of corn exported from thence in the last year, amounting to £2,938,180 afford a striking practical illustration of the foregoing reasoning:

					April, 1812	April, 1813
Highest price of	Wheat	per barrel of	20 stone	.. ..	83/–	60/–
,, ,,	Barley	,,	16 ,,	.. ..	44/–	29/–
,, ,,	Oats	,,	14 ,,	.. ..	34/–	23/–

"In the last 5 years the value of the whole imported was £18,934,359; of this was Irish corn £6,507,884 . . ."

Events, contemporaneous with, and subsequent to, the publication of this Report were the exaltation of the Plough in Ireland, and investigations by private individuals as to the resources of the country.[31] As regards the former, the various Farming Societies promoted the holding of ploughing-matches, in many counties, which invariably were attended by all classes of Society; splendid banquets usually concluded these events at which the winning ploughmen were the honoured and toasted guests.[32] While the Select Committee was sitting, Wakefield's two well-known volumes appeared;[33] the purpose of this work is specified in the author's preface--to point out the resources of Ireland and "to recommend the manner in which they may be employed to the greatest public advantage." The impetus thus given to tillage had far-reaching results, the nature of which are outside the province of this note. With the spirit of Wakefield's enquiries must also be associated *Mason's Statistical or Parochial Survey of Ireland*, the first volume of which appeared in 1814.

Of the increase in tillage during the Napoleonic wars, there is abundant evidence of a general nature.[34] Precise figures are only available, however, in rare instances, and for relatively small units, such as that already indicated in regard to one of the parishes of Portnahinch barony. Even here, the period comprehended, 1813-1819, includes post-war years.

It now remains to explain the sources of authority for the sub-divisions of the barony on which Mason based his "Survey and Census" of 1819, as well as for the estimates given of their respective areas. These matters, it is regretted, involve a somewhat lengthy discussion, but apart from their being fundamental considerations, it is hoped that incidentally the difficulties confronting statisticians, in the existing conditions of surveying and cartography will be made apparent.

The initial proceedings may well be conceived to have been concerned with obtaining lists of the denominations or townlands, in the respective

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31. It will be recalled that Napoleon's *Continental System* and England's *Orders in Council* both aimed at mutual blockade, leading to the annihilation of neutral trade and, in 1812, to war with America. With trade at a standstill in 1810-11, England's industrial classes faced starvation; furthermore, the maintenance of the armies in the Peninsula was threatened by the loss of the corn supplies hitherto imported. The Czar's secession from the *Continental System*, in 1811, relieved the situation.

32. For particulars of these ploughing-matches, which became fashionable events in country life, see *The Irish Farmer's Journal* for the years indicated. Horses and trained oxen frequently competed.

33. *An Account of Ireland, Statistical and Political*, by Edward Wakefield. The excerpt given from the preface may here be expanded: "Contemplating the present state of Europe, and the wonderful change which has taken place in the general system of continental politics it becomes the duty of every well-wisher of Great Britain to point out her resources . . . To point out the advantages which England might derive from Ireland . . . is the principal object of the facts and observations collected in the following sheets . . ."

34. "At present a person may travel 110 or 115 miles and meet little less than corn or potato fields. They are seen stretching up to the very top of the mountains."—Newenham. *The Population of Ireland*, 1805, pp. 56-7.

parishes comprising the barony. Under the caption "Names of Townlands and other Sub-divisions" Mason provides two lists of places, one in respect of the parish of Lea and the other in respect of that of Coolbanagher. Nowhere, however, in his text is the authority specified from which these were derived. A column is furnished purporting to express the area of each "townland" according to the "Down Survey," clearly implying that this document had been consulted. In adjoining columns the areas, so quoted, are compared or contrasted with the "estimated" acreable contents of each place. One other source available to Mason would be the archives of the Grand Jury located in the County Treasurer's Office. It is, however, first desirable to determine the relationship of Mason's Survey to the Down Survey. The latter may briefly be considered in two connections (1) as to the general nature of its content and (2) the use to which it was applied in local administration.

The Down Survey, made under the direction of William, later Sir William, Petty, A.D. 1655-57, consisted of parish and barony maps accompanied by "Books of Reference" including terriers or lists of lands ; the parish maps expressed the names, admeasurements and boundaries of lands forfeited in consequence of the wars begun in 1641, Church lands and Crown lands.[35] The admeasured areas were returned in two distinct classifications for each denomination surveyed, *viz.*, "Profitable" and "Unprofitable," the "Profitable" being again distinguished into arable, pasture and meadow. Unforfeited lands were not admeasured. The Down Survey parish maps of Lea and Coolbanagher which were extant at the date of Mason's Survey, are unfortunately no longer available. Closely contemporaneous with, and related to, the Down Survey are the series of documents known as the "Books of Survey and Distribution."

Compiled subsequent to the Restoration of Charles II from previous surveys, including the Down Survey, these Books have survived the years, and exist for each Irish county. Here the names and areas of all forfeited lands, profitable and unprofitable contents being distinguished, are recorded, together with the names of unforfeited lands and Church lands. Examination of the "Queen's" county volume shows that approximately 83 per cent. of the total number of townlands comprising the barony of Portnahinch had been forfeited and 17 per cent. unforfeited. Place-names and their boundaries to the extent of the former percentage would, therefore, have been returned on the parish maps, should these have been consulted by Mason. With the exception of two place-names and allowing for variation in spelling, every denomination set out in the Book of Survey and Distribution can easily be identified in Mason's lists. Further, the acreable contents of the "Profitable" land, in each denomination, agrees with the Down Survey figures quoted by Mason. So much for agreement.

35. T. A. Larcom (ed.) *The History of the Survey of Ireland, commonly called the Down Survey, by Doctor William Petty*, A.D. 1655-56 (Dublin 1851) ; see also paper read before R.I.A. by W. H. Hardinge. *Trans.* vol. XXIV, antiquities, pp. 45-99. A recent contribution appears in *Irish Historical Studies* by S. Ó Domhnaill under the title "The Maps of the Down Survey" ; vol. III, No. 12.

As already stated, unforfeited lands were not admeasured; some seven of the fifty-three "Townlands" given in Mason's lists fall within this description, and for these he purports to quote the Down Survey admeasured areas. Closer examination disclosed that the Down Survey areas given by Mason in respect of the forfeited lands excluded the "unprofitable" acreable contents in each of such denominations. Clearly, therefore, it was not from the original Down Survey documents that the particulars quoted in this connection were procured.

The Down Survey, however, fulfilled another purpose besides that of effecting land-satisfactions, and of forming the basis of title of a new landed settlement; it had been widely availed of for the purpose of local fiscal administration.

Prior to the provision of the Ordnance Survey and Valuation of Ireland, 1834-1854, county assessments, it may be recalled, were made without reference to any system of uniformity. In some parts of the country, the assessment was made by the civil division of ploughlands varying in size and value but rated at an equal sum; or again by "townlands" whose assumed areas bore no defined proportion to their actual contents. A Select Committee reported in 1815, after a minute investigation, "that some mode should be taken to render Grand Jury assessments more equal by correcting the defects arising from apportioning the county rate according to old surveys, calculated on the measure of land formerly deemed profitable . . ."[36]

Examination of a number of abstracts of County Books, or "Keys" of the County, as the rate books were then called,[37] showed that these "old Surveys" were Strafford's Survey of 1637 and the Down Survey of 1657. From these sources the original rate books were compiled continuing unaltered, from century to century, without reference to improvements which had materialised.

Happily, an abstract of the "Key" of the "Queen's" County and of the barony of Portnahinch is available.[38] This specifies the "Townlands" of the barony, without parochial allocation, and their respective acreable contents chargeable with taxes. It does not specify from what source these particulars were obtained, but the great bulk of the acreages correspond exactly with those of the "profitable" lands of the barony as returned by the Down Survey. Similar agreement exists in regard to the names of the "Townlands." It may be said at once that the lists appearing in Mason's "Survey and Census" represent in almost every detail a copy of this rate book. The areas of the "unforfeited" lands, appearing in the same document were derived, apparently, from a source other than that of the Down Survey.

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36. Reprinted in *Report on the Survey and Valuation of Ireland*, 1824.
37. These abstracts are printed in the course of the foregoing Report.
38. *Ibid.*

Though this explains the origin of the sub-divisions of the barony, adopted by Mason, some further observations are called for on this subject.

As will be seen from the Appendix to this note the "Townlands" of the barony are returned within two parishes—Lea and Coolbanagher. This corresponds with the parochial division of the barony as expressed by the Down Survey. The barony, however, also contained the parish of Ardea, which, according to Mason, had been united to Coolbanagher "for nearly two centuries," the two forming "as to all civil purposes" a single parish. Under this arrangement the sub-division of the parish of Lea numbered twenty-six "townlands": the union of Coolbanagher, twenty-seven—in all, fifty-three.

There are now, however, some sixty-nine townlands in the barony; again, names appearing in Mason's list are not to be found on the Ordnance Survey 6-inch maps. An explanation of these matters is, therefore, called for. In seventeenth-century documents, the place-names of properties are usually found recorded under the description of "Denomination of land"; these properties are frequently equated with existing civil divisions, notably ploughlands. The word "Denomination" also was used in official and judicial proceedings, affecting lands forfeited in Ireland, to express the tract, or parcel of land, comprised within any one surround delineated on the Down Survey maps. Such surrounds purported to coincide with the boundaries of forfeited properties; on the superimposition of such surrounds on the modern six-inch Ordnance Survey Maps they are frequently found to correspond with the boundaries of townlands as defined by the latter. On the other hand, the surround of a single denomination, when so superimposed, has been likewise frequently found to include two or more modern townlands or parts of adjoining townlands. This latter may be illustrated by reference to two "Townlands" appearing in Mason's "Survey and Census"—"Graiguecinniskerry" and "Rathronshin," both in the parish of Lea. The Down Survey "surround" of the latter when superimposed, as indicated, includes the greater part of the modern townland of Rathronshin, nearly the whole of the townland of Coolroe and part of an adjoining townland called Bellegrove. The "surround" of "Gragueinniskerry"—a name which has disappeared, includes the two modern townlands of Kilbracken, Bellin and part of the townland of Fisherstown. Incidentally, this explains the disparity between the names and the number of "Townlands" as given by Mason and those returned by later Censuses, as defined by the Ordnance Survey; place-names no longer existing or forgotten, likewise come to light in this process of identification.[39]

The sub-divisions of Portnahinch, given by Mason while representing the entire barony may be said, therefore, to correspond with denominations of land, connoting property divisions rather than with townlands as now

39. See the collection of Quit Rent Office six-inch O.S. maps now lodged in the Public Record Office.

understood. It is significant in this connection, that for each and every "Townland" appearing in the "Survey and Census," the name of the proprietor in fee is provided in the adjoining column, as is likewise detailed particulars of the actual rent paid per acre.

So much for the origin and significance of the sub-divisions. The determination of how Mason arrived at their acreable contents, expressed in Irish measure, is the final consideration. When these are totalled, they amount to 19,142 acres, the figure given by Mason as the total area of the barony. The equivalent of this in statute measure is 31,006 acres representing a deficiency of 4,829 acres when compared with that of the Ordnance Survey area of the barony. Equation on a parochial basis showed that the deficiency was not confined to either divisions. With the barony and parish came to an end the resources of equation so far as statute acreages were concerned. Six years subsequent to Mason's Survey, however, the Tithe Applotment proceedings, for the Portnahinch parishes, provided a certified record of their acreable, titheable, contents. Here the same sub-divisions prevailed so that it was possible to check "Townland" by "Townland" the areas in Mason's Survey. While, in a few instances, the acreable contents were close, collation showed that the deficiency was spread over the great majority of the "Townlands."

The papers relative to the "Survey and Census," if now available, would very likely disclose the procedure followed in the process of "estimation." In their absence, conclusions can only be drawn from the appearance in the text of certain particulars. While the local Rate Book would contain the names of proprietors, the details given of "actual" rents, paid per acre, on each distinct property—there were some seventeen estates concerned, would have to be obtained elsewhere. Such details presuppose the existence of leases, particulars of which would be most readily forthcoming from the rentals of the various proprietors. The acreable contents of lands under tillage and pasture should, it is thought, be fairly well known, particularly the former. Tillage crops were the subject of tithes of which Mason also furnishes particulars, per acre, derived, no doubt, from the respective Ministers' Valuation Books.

If the assumption be correct—there is no evidence to suggest that a circumferentor or a theodolite was employed, that the "estimated" areas were obtained from estate records, then the conclusion is inevitable that each "Townland" contained a greater area than that which appeared on the face of whatever documents were examined. The genesis of this underestimation was the Down Survey. It is now a well-established fact that the areas of "Townlands," or denominations, which the Down Survey expressed, and which governed the distribution of estates, were less by at least "one-

sixth" than the actual contents.[40] When, indeed, to Mason's total acreable contents, this fraction thereof be added, equation with the Ordnance Survey area of the barony is obtained less, approximately, a few hundred acres. By the addition, therefore, of one-sixth to the total areas returned in respect of the various "Townlands," the true position may approximately be determined.

In the existing conditions of surveying and cartography, perfection could not be expected; designed as a model—representing substantially existing facts, Mason's compilation is to be viewed in this category rather than that as already suggested of a certified return. Until the Ordnance Survey had completed its work of mapping and defining the divisions, and sub-divisions of the country, the returns suggested by him were incapable of collection. In one particular connection, Mason was well in advance of many later Censuses in so far as he aimed at the return of the areas in pasture on each sub-division.[41] His work well illustrates the spirit of enquiry that characterised the early decades of the nineteenth century when, for one reason or another, an intimate knowledge of the resources of this country was desired.

. . . . .

In the years 1825-1827, in conjunction with other areas of the country, the barony of Portnahinch was again surveyed, on this occasion, for the purpose of the assessment of Tithe Composition. The documents which were the outcome, and expression, of these proceedings recorded certain detailed facts as to landholding conditions then prevailing in Ireland. These included the names and numbers of the landholders on each townland, the areas of their farms in Irish measure, and the valuation and qualities of the land—the latter numerically expressed, on which the Tithe composition was apportioned. From these particulars, authenticated by commissioners representative of the various interests concerned, certain summarised statistics appeared capable of compilation in respect of the number, and of the areas of farms in size-groups. Though now a matter of historic interest, it may be recalled that the absence of the latter feature—areas in size-groups, from the Census returns contemporaneous with the publication of the volume, *Ireland, Industrial and Agricultural,* 1901, was the subject of comment by the Editor, the late Dr. Coyne: "No statistics unfortunately of the relative

40. See paper read before R.I.A. by W. H. Hardinge "On manuscript mapped and other townland surveys in Ireland of a public character embracing the Gross, Civil and Down Surveys from 1640-1688." *Trans.* R.I.A. vol. XXIV. At page 281 Hardinge states "I have shown that the actual were more than the expressed contents of the townlands on the Down Survey Maps by about one-sixth part . . ." In a former paper (p.22) in the same series, he estimated the deficiency at one-fifth. When the parishes of Portnehinch barony are taken separately the deficiency in Lea is nearly one-fifth and that in Coolbanagher one-eighth. See, also, paper in *Irish Historical Studies*, already quoted.

41. "While the areas under crops and the numbers of live stock on each farm are available for each county for each year from 1854 to 1874 the area under pasture is unfortunately not available by *counties* although published for Ireland as a whole." *Agricultural Statistics* 1847-1926.—Compiled by Dept. of Industry and Commerce.

portions of the area of cultivated land comprised in each of the size-groups of holdings are available in Ireland. This proportion would have to be taken into consideration before the full significance of the distribution of farms in this country could be appreciated." Dr. Coyne then furnished a Table taken from the French *Statistique Agricole*, 1897, which brought out "the importance of this point." Areas of farms in size-groups, however, had been furnished by the Census Commissioners of 1881, on a county basis, and in conjunction with the population figures within each such size-group. These returns were then collected in pursuance of a suggestion made to Government by the *Statistical and Social Inquiry Society of Ireland*. Again, in 1908, similar particulars were called for by the Commission of Enquiry into the Congested Districts. In later years, areas of holdings in size-groups formed a valuable feature of the annual *Statistical Abstract* issued by the Department of Industry and Commerce. The determination in this connection, of the position existing a quarter of a century before the Famine of '47, so far as the Tithe Applotment records permit, would appear, therefore, to be well warranted, the information to be derived constituting an important item of the economic history of the country. On representation of the facts to the *Director of the Statistics Branch* of the Department of Industry and Commerce, who examined a specimen volume of the Tithe Applotment Books, he kindly agreed, in this particular instance of the barony of Portnahinch, to have compiled the statistics suggested, on the lodgment of the necessary documents. To this courtesy is due, therefore, the three Tables, accompanying this note, specifying the following particulars: (1) the actual number of holdings and total acreages, in statute measure, on each specified size of holding in 1825, (2) the number of holdings and total acreage in the same groups for the years 1825, 1880 and 1931 and (3) the percentage distribution in each such classification.

In the issue of the *Journal* for 1941, the history of the Tithe Composition Applotments, initiated by legislation enacted in 1823, was outlined, with particular reference to the agricultural returns of six Tipperary parishes. On the present occasion it is only necessary, therefore, to refer, summarily to matters bearing on the history and authenticity of the text from which the foregoing statistics were compiled.

Prior to 1823, the imposition of tithes was confined mainly to tillage land; they had been paid theretofore, according to the different customs, and rates, prevailing over the parishes of the country. The main objects of the Act of 1823, under which pasture land was no longer exempt, were to effect a more equitable distribution of the charge, and to render the income therefrom more certain in amount and easier of collection. For these purposes, provision was made by the Act for the election and appointment of two commissioners, representative, in each parish, of the diocesan authority and of the landholders. It was the duty of these commissioners to fix the income of the tithe-owners in either of two ways (1) by valuation, based on average income, and average corn prices, over the respective septennial years, 1814-1821, 1823-1830 or

(2) by agreement between the incumbent and the vestry, the latter being representative on a rateable basis of the occupiers of the parish. Roads, canals, waste lands, bog and thickly planted woods were exempted. The commissioners were empowered to cause a survey and admeasurement of lands, where necessary, to be made, to form an estimate of the value of the lands, and to apportion equally and in proportion to the true annual value, the income which had been fixed on the landholders of each parish. Whether the procedure was by agreement or valuation, the commissioners in their relative certificates were to specify the average price of wheat or oats (whichever was the principal corn grown in the district), calculated from the returns in the *Dublin Gazette*, over either of the septennial periods already mentioned. Finally the details of the assessments were to be entered in a book, signed and certified by both commissioners. Hence, the origin of the Tithe Applotment Books, declared valid by Act of Parliament, 1 and 2 Vic. c. 109, and now deposited in the Public Records Office, The Four Courts, Dublin.

For each of the three parishes, comprising the barony of Portnahinch, there is a distinct Applotment book to each of which is attached a certificate in the terms above indicated, signed by the respective commissioners. These may briefly be noticed in their order of date. The certificate of the applotment of the parish of Lea is dated 19th January, 1825, and is signed by Robert Moore and George Adair; wheat is declared to have been the principal corn grown in the *parish*, the average price of which for the seven years preceding the 1st November, 1821, is stated to have been £1 18s. 8½d. per barrel; the commissioners further certified that they had "viewed every farm and plot of ground and set forth the quality of land contained in each as compared with the remainder of the parish and the amount of acres, roods, and perches taken in nearly all cases from actual survey, either in the possession of the landlord or occupying tenant." These in Irish measure represented 11,083 acres, 2 roods and 14 perches. The equivalent in statute measure will be found in Table I of the Summary Statistics presently to be given. The amount of income fixed was £900 Irish currency, or £830 15s. 4½d. British.

The certificate for the parish of Ardea is dated 30th December, 1825, and is signed by John Tibeaudo of Portnahinch and Robert Welch of Maryboro', the commissioners for the parish. Wheat is declared to have been the principal corn grown in the *county*, the average price being the same as in the parish of Lea. Area, 4,434 acres and 36 perches, Irish measure. The income was fixed at £281 Irish or £259 7s. 6d. British currency.

The certificate for the remaining parish of Coolbanagher is dated 22nd April, 1826—the Applotment Book bears the date 29th January, 1827, and this was also signed by Mr. Tibeaudo and Mr. Welch. It is stated that the tithes in this parish had formerly been valued at a lower rate than in surrounding parishes, no tithe of potatoes having been demanded; one eleventh

accordingly was added to the income fixed at £275 Irish or £253 16s. 11d. British. Area, 5,337 acres, 3 roods, 25 perches Irish measure.

The Applotment Books, to which the foregoing certificates were attached, constituted the text from which the Statistics compiled by the Statistics Branch were compiled.

To obtain particulars of the areas of farms in size-groups, special forms, containing the Irish measures, were prepared; these corresponded with the size-group classifications in statute measure—under 1 acre, 1 to 5 acres, and so on, in an ascending scale to the group "over 200 acres." On conversion into statute measure, the total area amounted to 33,665 acres, the difference between this, and the Ordnance Survey area of the barony being accounted for by the exclusion of bog, waste, thickly planted woods, and areas under roads and water.[42]

The Tithe Applotment proceedings as will have been observed, were spread over the years 1825, 1826 and 1827. Two parishes fall within the first year, and one within the last two. It will be allowed that the proximity in dates is sufficiently close for the expression, as at the year 1825, of landholding conditions in the barony.

Table I of the Summary Statistics may now be given, the remaining Tables, showing the position in 1880 and 1931, being postponed until the final stages of this note.

42. The area of bog and woods, at the date of the Grand Jury map, 1805, is shown thereon to have been the equivalent of 2,400 statute acres. Mason's estimate in 1819 gives an equivalent area of 2,390 statute acres for bog alone. The Ordnance Survey documents show the area in 1835 to have been approximately 1,900 acres. I am indebted to Major Nolan of that Department for this last item.

BARONY OF PORTNAHINCH, CO LAOIGHIS, 1825.

TABLE 1

Number of holdings and total acreage on each specified size of holding in the year 1825, from particulars in Tithe Applotment Books. Actual figures.

Parish	Under 1	1–5	5–10	10–15	15–30	30–50	50–100	100–200	Over 200	Total
	Size of Holding in Statute Acres									
	(a) Number of Holdings									
Ardea	177	204	109	59	75	22	16	6	1	669
Coolbanagher	28	141	99	37	75	27	24	6	3	440
Lea	181	421	211	133	169	62	44	15	8	1,244
Total No. of Holdings in Barony	386	766	419	229	319	111	84	27	12	2,353
	(b) Total Acreage									
Ardea	65	565½	825	707¾	1,578½	881	1,111½	1,071¼	324	7,129½
Coolbanagher	15¾	406¾	713¼	464½	1,651	1,043¾	1,649¼	893	1,805¼	8,643
Lea	85¼	1,173½	1,551½	1,668¾	3,622¼	2,335¼	2,911¼	2,193½	2,347	17,893¼
Total Acreage of Barony ..	166	2,145¾	3,089¾	2,841	6,851¾	4,260	5,672½	4,162¾	4,476¼	33,665¾

In the foregoing Table, the number of holdings in the groups under 30 acres, represent 90 per cent. of the total number of holdings in the barony, the corresponding acreage in these groups representing 44.6 per cent. of the total area. The number of holdings, in the groups above 50 acres, represent 5.2 per cent. of the total number, the corresponding acreage being 42.2 per cent. of the total area. In the group "30-50" acres, 4.7 per cent. represent the number of holdings, and 12.7 per cent. the corresponding acreage.

From particulars, many of a retrospective nature, furnished to the Poor Enquiry Commission of 1835, some facts may be learned as to the nature and state of agriculture, in the barony of Portnahinch, over a period closely contemporaneous with that of the Tithe Applotment proceedings. These may. here, briefly be summarised.

Though the area in grazing land had decreased in the preceding five years, that is, from 1830 to 1835, the alteration was not "very perceptible" over the period 1825-1835. The figures furnished as representing the division of land in the barony, as of the latter year, show that exclusive of bog and waste, woodland and common, 67 per cent. was under tillage and 33 per cent. in pasture.[43] Small holdings were almost all under tillage "while farms of 20 Irish acres were one-third tillage" and those of 50 to 100 Irish acres one-fourth tillage. "The average size of the tillage farms is about 20 acres." "About 50 acres of tillage land is the largest quantity held by one farmer."

As to the mode of agriculture, the course of crops adopted on the larger farms was first year potatoes, second wheat or barley, third oats ; land was then laid down to grass, by some farmers, from two to five years. On the smaller farms the rotation usually adopted was first year potatoes, second wheat, barley or oats. The corn crops were generally weeded in June, the work costing from two to three shillings per acre. The seed-wheat was pickled and limed to preserve it from disease. About 18 stones, on an average, were sown per acre (Irish) but more was used on poor soils, or if late, and less on rich soils, if early.

The markets in the district included Mountmellick and Portarlington, and a little farther afield, Monasterevan, Maryboro' and Stradbally ; at Mountmellick much wheat was converted into flour for the English market.

Experience in the barony had shown that on a farm of 100 Irish acres, consisting of 75 acres of grass and 25 acres of tillage, about four constant

43. "This barony contains 22,567 acres Irish Plantation Measure of which 100 acres are public common, 650 woodland, 13,294 acres arable, 6,642 acres pasture, 1,661 acres bog and 220 waste."—Appendix F. Poor Enquiry Rep. 1836.

labouring men, and one boy, and three horses were kept. The amount of labour by occasional labourers, including harvesting and all other operations, "amounted to about as much more in the course of the year."

Amongst the small farmers, the artificial grasses were not grown ; some clover, however, a few vetches, rye-grass and trefoil were cultivated by the larger farmers ; to a small extent turnips and mangel-wurzel were also grown.

The increase within recent years—prior to 1835, of the cultivation of the potato-"lumpers," was attributed to numerous causes (1) the introduction and extension of the drill system, (2) stall feeding of cattle, (3) the use of bog stuff (peat) for manure and (4) "the increase of the population, and of poverty among the working-classes, which had caused a diminution in the use of meal and other food and which had thrown them more and more for subsistence upon potatoes alone."

There were then no dairy farms in the barony, each farmer only dairying a few cows, or the milk left by the calves which had been reared. The grazing land was considered to be of second quality. Increased intercourse with England, in consequence of the introduction of steam navigation, and to improved methods of agriculture had led, however, to more cattle being fattened for export. The largest grazing farm—there were few, in 1835, in the barony, consisted of 200 Irish acres.

The proprietors consisted of resident landlords, non-resident and absentee landlords. Middlemen holding under very long leases at nominal, or low, rents were considered in the light of proprietors. As many as three and sometimes four middlemen frequently interposed between the head landlord and the occupier. A considerable area of the barony was held direct from the proprietors in fee, without the intervention of middlemen. As a class, the latter were stated to have been almost extinct in the barony, ten years subsequent to the date of the Tithe Applotments. To the middlemen were attributed, in a large measure, the practice of sub-dividing the land amongst small occupiers who were generally ejected at the end of the middleman's lease. Leases were then usually granted for one life or 21 years.

Between 1825 and 1835 rents had decreased considerably, "full 20 per cent. on an average." This reduction, it was claimed, fell short of that which had taken place in England during the same period, the explanation being that in consequence of no other means of employment, or subsistence, there was a greater competition for land in Ireland.[44]

44. The farmers of the barony depended on their corn for the payment not only of the rent but of all their expenses. "The ordinary farmer makes no calculation at all as to the proportions of the produce to be assigned to the several expenses of labour, utensils, buildings, and the maintenance of his family, except that immediately after harvest he depends upon his corn for the payment of the half-year's rent and frequently of that of the whole year and of the chief of his other outgoings and expenses."

What was represented to the Poor Enquiry Commissioners as to the decrease in grazing farms, and the inferred increase of tillage, in the barony, during the period 1830-35 is confirmed by another source. Contemporaneous with the Tithe Applotment Books for Ireland, as a whole, are the returns of the sale of wheat, oats and barley in the market-towns of the country during each of the ten years 1826-1835. These were collected in 1836 by the police authorities in pursuance of an order of a Select Committee of the House of Commons then inquiring into the cause of agricultural distress in England; they were published as an Appendix to the Third Report of this Committee.[45] At this time, corn was "poured"—to use the language of Sir Robert Peel, into England from Ireland, a peak year being 1833 when 244,201 quarters of wheat[46] 107,519 quarters of barley, and 1,762,519 quarters of oats were exported from the latter to the former country.

The returns of the corn sold, over the years specified, in each of the "Queen's" county market-towns, is signed by the sub-Inspector of Police at Maryboro' and dated from that town, March 31st, 1836. It bears the following certificate: "This Return is made from those furnished by the Chief Constables of the County who procured theirs from the best sources of information they could obtain on the subject."

While the "best sources of information" are not specified, the certificates given in respect of other counties indicate that the information obtained was derived from the records of weigh-masters, millers, brewers, distillers and corn-dealers. The fact, however, that quantities of grain could have been disposed of without being brought to market, or of which no account had been preserved, was a qualification, characterising many certificates, as to the relative figures representing complete returns of the grain sold within the different regions. Though the "Queen's" county certificate is given without reservation, the returns which accompany it, here printed as Appendix B (p. 286) should be read as representing only the fullest particulars that could be obtained. While reflecting the extent of tillage, and the growth of corn crops within the "Queen's" county, the products of other adjoining areas are to be presumed as included in the returns. Though the sales at Portarlington are suggestive of an average basis, those at Mountmellick strikingly illustrate the growth of that market. This latter may partly be explained as indeed the return suggests, by the opening of a distillery in 1830, and by the extension to that town, in 1831, of the Grant Canal.

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45. Third Report from Select Committee appointed to enquire into the State of Agriculture. 1836.

46. Approximately, 1,555,742 barrels.

The expansion in tillage, during the five years 1831-35 as contrasted with the quinquennial period 1826-1830, is most clearly seen from the total sales in all towns for each of the ten years. This is exhibited in the following Table, the market towns concerned being Maryborough, Mountrath, Rathdowny, Abbeyleix, Carlow Graigue, Stradbally, Portarlington and Mountmellick.

Year	Wheat, Barrels	Oats, Barrels	Barley, Barrels	Year	Wheat, Barrels	Oats, Barrels	Barley, Barrels
1826	45,325	18,733	16,580	1831	63,616	30,303	23,130
1827	54,932	19,836	17,860	1832	79,573	36,014	29,202
1828	55,920	22,026	17,105	1833	82,751	45,030	33,195
1829	54,337	25,217	15,831	1834	93,891	46,989	28,879
1830	58,258	25,069	29,008	1835	99,313	58,895	44,994

The Returns as to Sales were accompanied by a Return of Average Prices over the years 1833, 1834 and 1835 : this is also given in Appendix B.

Thus, inferentially, would appear to be well-established the figures, furnished to the Poor Enquiry Commission of 1835, indicating that 67 per cent. of the barony of Portnahinch was then under tillage.

Finally, Tables 2 and 3 of the comparative statistics, as regards holdings and areas in size-groups within the barony, as at the years 1825, 1880 and 1931, prepared by the *Statistics Branch* of the Department of Industry and Commerce may be given :

BARONY OF PORTNAHINCH, CO. LAOIGHIS

TABLE 2

Number of holdings and total acreage on each specified size of holding, in the years 1825, 1880 *and* 1931.

Year	Size of Holding in Statute Acres									All Sizes
	Under 1	1–5	5–10	10–15	15–30	30–50	50–100	100–200	Over 200	
(a) NUMBER OF HOLDINGS										
1825	386	766	419	229	319	111	84	27	12	2,353
1880	228	222	332		224	116	86	53	20	1,281
1931	133	141	96	72	167	113	97	65	18	902
(b) TOTAL ACREAGE										
1825	166	2,146	3,090	2.841	6,852	4,260	5,672	4.163	4,476	33.666
1880	204	702	3,417		5,111	4,662	6,145	7,405	8,189	35,835
1931	123	466	790	978	3,992	4,762	7,306	9,562	7,762	35,741

BARONY OF PORTNAHINCH, CO. LAOIGHIS

TABLE 3

Percentage distribution of number of holdings and total acreage on each specified size of holding, in the years 1825, 1880, and 1931.

Year	Size of Holding in Statute Acres									All Sizes
	Under 1	1–5	5–10	10–15	15–30	30–50	50–100	100–200	Over 200	
	(a) Number of Holdings									
1825	16.4	32.6	17.8	9.7	13.6	4.7	3.6	1.1	0.5	100
1880	17.8	17.3	25.0		17.5	9.1	6.7	4.1	1.6	100
1931	14.7	15.7	10.6	8.0	18.5	12.5	10.8	7.2	2.0	100
	(b) Total Acreage									
1825	0.5	6.4	9.2	8.4	20.3	12.7	16.8	12.4	13.3	100
1880	0.6	2.0	9.5		14.3	13.0	17.1	20.7	22.8	100
1931	0.3	1.3	2.2	2.7	11.2	13.3	20.5	26.8	21.7	100

From Table 2 it will be observed that between 1825 and 1931, the total number of holdings in the barony had decreased by 1,451 or 61.6 per cent. The percentage number of holdings (Table 3) under 5 acres in extent declined between 1825 and 1931 from 49 to 30. As regards total acreage, it will be seen that the acreage under holdings of 50 acres or more increased from 42 per cent. in 1825 to 69 per cent. in 1931, while there was a corresponding decrease in the acreage of holdings under 30 acres, the proportion borne by the class "30-50" acres remaining substantially the same.

Changes shown, since 1880, include a decrease in the number of holdings from 1281 to 902 or 29.5 per cent. of which a large part was borne by the class "Under 1 Acre." During the same period 1880-1931, the acreage of holdings, under 30 acres in extent, declined from 26 per cent. of the total acreage to 17 per cent., with a corresponding increase in the classes "50-200" acres."

The foregoing figures, particularly those for 1825, will be read in the knowledge of the outstanding economic and financial changes then, and in proximate years, affecting the entire country.[47] The establishment of Free Trade between England and Ireland came in 1824, the same year witnessing the assimiliation of the currency; the disestablishment of the forty shillings freeholder was soon to follow; these events taken in conjunction with the development of steam navigation, and the opening of the railways, all indicated stages, from 1800, of a new era in Irish life which was to reach a tragic climax in the year 1847.

47. The population of the barony increased from 12,374 in 1819 to 15,365 in 1841; by 1881 it had fallen to 8,648; in 1891 it was 7,521. After this last specified year, the population figures can only be given in respect of the rural areas of the barony, represented by the District Electoral Divisions in which they fall. For these the populations in 1901 were 5,896 and in 1936, 5,444. The population of that part of Mountmellick town, which was formerly within the barony, cannot be ascertained for these years. Portarlington town, within Laoighis county, had a population of 1,295 in 1936.

APPENDICES

With Explanatory Notes

APPENDIX A.—Abstract from Survey and Census of 1819, preceded by original Title-Page.

APPENDIX B.—Returns of Sales of Grain in Laoighis County, 1826-1835, with particulars of average price.

APPENDIX A

(Title-page of Portnehinch Survey)

SURVEY, VALUATION, AND CENSUS OF THE BARONY OF PORTNEHINCH,

COMPILED IN THE YEAR 1819,

BY

WM. SHAW MASON, ESQ., M. R. I. A.

REMEMBRANCER AND RECEIVER OF FIRST FRUITS, AND SECRETARY TO THE BOARD OF PUBLIC RECORDS; ALSO AUTHOR OF THE STATISTICAL ACCOUNT OF IRELAND, AND NOW SUPERINTENDING THE PROCEEDINGS UNDER THE POPULATION ACT.

"It is obvious, that no individual can rationally undertake to improve his landed property, without knowing its extent, the soil of which it consists, the number of farmers by whom it is occupied, the state of the buildings erected on it, the crops which it is capable of producing, the best means of cultivating it, &c. In the same manner, no Government can improve a country, or ameliorate the condition of its inhabitants, without entering into minute enquiries of a similar nature, for the purpose of at least removing all obstacles to improvement."—*Sir John Sinclair's General Report of Scotland.*

DUBLIN:

1821.

Appendix A—(continued)

ABSTRACT OF SURVEY AND CENSUS OF 1819

Survey and Valuation of the Barony of Portnehinch.

Names of Townlands or other Subdivisions	Farmers and Labourers	Quantity of Land by Estimation: Quality							Value of Land: Actual Rent per Acre		
		Tillage	Fallow	Meadow and Pasture	Mountain Pasture	Woods and Plantations	Bog	Unprofitable	Best	Middling	Poorest
Parish of Lea	Number	Acres	Acres	Acres		Acres	Acres	Acres	s. d.	s. d.	s. d.
Lea	112	294	3	467	—	—	—	—	50 0	28 0	20 0
Controversy Land	28	44	—	64	—	—	—	—	40 0	—	—
Garryvacuin ...	10	61	—	82	—	5	40	—	40 0	30 0	20 0
Lough	35	100	—	96	—	—	50	40	45 6	40 0	20 0
Doolagh	10	30	—	130	—	—	—	—	22 9	—	—
Kilbride	89	130	—	120	—	—	40	60	34 1½	12 0	12 0
Ballybrittas ...	96	400	—	540	—	15	300	200	40 0	8 0	8 0
Ballintogher ...	84	340	—	420	—	—	20	—	40 0	34 1½	34 1½
Coolterderry ...	47	312	—	150	—	—	50	40	136 6	9 0	9 0
Kilmullen ...	38	140	—	126	—	—	40	—	41 0	8 0	8 0
Ballycarrol ...	23	190	—	38	—	8	—	—	34 1½	0 3	0 3
Derrynaturcheon	11	110	—	40	—	—	30	—	34 1½	34 1½	34 1½
Ballyteagueduff ...	47	212	—	161	—	—	—	—	30 2	20 0	20 0
Clonerne	23	101	—	81	—	8	—	—	34 1½	34 1½	34 1½
Rathronshin ...	95	240	—	264	—	—	200	—	40 0	34 1½	34 1½
Ballyfeboyle ...	3	101	—	122	—	110	100	100	23 0	23 0	23 0
Bracklone ...	9	56	—	100	—	—	—	—	60 0	45 6	45 6
Tierhogher ...	37	91	—	102	—	—	—	—	45 6	45 6	22 9
Graguenniskerry }	106	141	—	166	—	—	—	—	40 0	40 0	40 0
Upper Killinacourt }		400	60	261	—	—	—	—	40 0	34 0	14 0
Ballymorris ...	65	200	—	16	—	56	—	—	40 0	40 0	40 0
Rathless	8	76	18	54	—	—	—	—	32 0	12 0	12 0
Ballyadden ...	42	91	—	64	—	—	—	—	25 0	25 0	25 0
Graguevine ...	18	60	—	95	—	20	—	—	12 0	12 0	12 0
Low. Killinacourt	30	110	20	136	—	—	—	—	25 0	22 9	22 9
Loughmansland ...	18	61	—	18	—	—	—	—	45 6	45 6	45 6
Total in Lea ...	1081	4091	101	3913	—	222	870	440			
Parish of Coolbanagher									s. d.	s. d.	s. d.
Achregar	46	141	—	150	—	—	40	—	160 0	60 0	40 0
Ballycollane ...	33	91	—	86	—	8	30	20	40 0	30 0	20 0
Ballycollenbeg ...	98	90	—	100	—	1	20	—	240 0	40 0	20 0
Brittas	28	150	—	97	—	6	—	—	17 0	16 0	14 0
Cappakiel or Ballymulroony }	102	340	—	350	—	10	100	—	50 0	20 0	12 0
Caron or Curraghane }	62	100	—	178	—	6	40	60	—	12 0	—
Cloncosney ...	15	24	—	40	—	—	5	—	22 9	22 9	22 9
Clonterry	17	50	—	200	—	50	—	—	44 0	30 0	20 0
Coolbanagher ...	178	341	—	241	—	100	—	—	18 0	12 0	12 0
Dangans }		100	—	74	—	9	—	—	40 0	30 0	20 0
Tinekell }	86	250	—	301	—	40	18	—	33 0	—	—
Old Gardens }		41	—	24	—	—	20	—	13 0	11 0	11 0
Portnehinch }		24	—	34	—	—	—	—	20 0	—	—
Derrydavy ...	27	60	—	51	—	—	15	—	24 0	22 9	20 0
Derryguile and Derrycloney }	129	286	—	309	—	—	50	103	50 0	30 0	20 0
Emo	19	40	—	640	—	311	61	—	[2]0 3	—	—
Killeen or Killeenlinagh }	10	51	—	200	—	40	42	—	23 0	17 0	—
Killenecast ...	7	30	—	66	—	—	—	—	44 0	44 0	44 0
Kilmenum }	66	250	—	72	—	9	—	—	32 0	22 9	22 9
—Glebe }		7	—	10	—	—	—	—	34 1½	34 1½	34 1½
Knightstown ...	6	41	—	68	—	6	30	—	50 0	45 6	—
Lauragh	3	16	—	25	—	11	—	—	18 0	—	—
Morett	159	811	—	511	—	5	—	—	24 0	14 0	11 4½
Strahard	27	100	—	210	—	—	10	—	52 0	40 0	20 0
Coolnevarnogue }		100	—	61	50	—	40	—	34 1½	22 9	20 0
Vaughans, &c. }	61	41	—	71	—	80	40	—	[3]0 3	—	—
M'Donells, &c. }		124	—	111	—	—	40	—	34 1½	30 0	20 0
Total in Coolbanagher ...	1179	3699	—	4280	50	692	601	183			
Total in Barony	2260	7790	101	8193	50	914	1471	623			

APPENDIX A—(continued)

EXPLANATORY NOTE

The foregoing acreages are in Irish measure.*

In amplification of what has already been stated with regard to the source of origin of the foregoing sub-divisions of the barony of Portnahinch, the first six "Townlands" of the parish of Lea fall within the classification of "unforfeited lands" and consequently were not admeasured for the purpose of the Down Survey. In the Book of Survey and Distribution for Queen's County, the denomination of Iniscolly (modern Inchacooly) is linked with that of Lea, the first "Townland" in the above list. In the series of Down Survey barony maps, 'Hibernia Regnum,' it is observed that the barony boundary of Portnehinch there given does not include Inchacooly; the Ordnance Survey six-inch map (sheet 5) shows, however, this townland to be south of and within "the old course of the river Barrow."

"Controversy Land," the second item on the list, is now known as "Ullard, or Controversy Land." The denomination of Ballybrittas includes the townlands, probably sub-denominations, of Ballyshaneduff or The Derries, Tullaghan and Rathmiles.

"Graigueinniskerry," as already stated, is now represented by the townlands of Bellin, Kilbrackan and part of the modern townland of Fisherstown. "Ballyfeboyle," a name which has likewise disappeared, is now represented by Bellegrove. The denomination of "Ballintogher" includes the townlands of Bolnagree, Killaglish, and Killinure. Courtwood is the modern appellation for "Killinacourt" Upper and Lower.

According to Mason, the parishes of Coolbanagher (also called Ballycollon) and Ardea had been united at the date of his survey, for "nearly two centuries."

The denominations comprising the latter parish are specified in the Tithe Applotment Book of 1825, and are here given in the form there rendered. Ackregare, Ballycollenbeg, Brittas, Clonterry, Derryguile, Derrycloney, Derrydavy and Cloncosney, Kilmenum, Kilenecast, Killeen, Laughragh and Ballinrudery, (this last Knightstown in Mason's list), Strahard, Tenrekill, Dangins and Portnahinch. With slight differences in spelling, all these place-names will be found in Mason's list.

The denomination of "Tinekill" included the townland of Ballycrossal, and that of "Derryguile," the townland of Sronagh.

In the foregoing group representing the parish of Ardea, the following lands were not admeasured on the Down Survey maps—Killeen or Killeenlynagh, Brittas and Kilmenum (Kilmainham). Included in the "unforfeited surround" are the townlands of Ballintaggart and Debicot.

The remaining lands form the parish of Coolbanagher. Here, also, certain denominations fall within the category of "unforfeited lands" and, therefore, were not admeasured for Down Survey purposes. They are Morett, Ballimullrooney and Kilmocilloge. It will be observed that Mason's text gives Cappakeel as a variant of Ballimullrooney; this is also the name which appears on the Ordnance Survey map. The last three places indicated on Mason's list—"Coolnevarnogue, Vaughans and McDonells" are represented by the modern townlands of "Coolnavarnoge and Coolaghy."—R.C.S.

*When toatlled the areas specified in the foregoing Abstract express the acreable contents of the barony as representing 19,142 acres made up thus:—

Parish of Lea	9,637	acres
„ „ Coolbanagher	9,505	„
Total ...	19,142	„

Appendix B

LAOIGHIS COUNTY

Particulars furnished to select Committee of Enquiry into Agricultural Distress in England 1836.

AN ACCOUNT, showing the TOTAL QUANTITY OF GRAIN sold in each of the several Market Towns in the *Queens County*, from the 1st January 1826 to the 31st December, 1835.

Years	Market Towns	Description of Grain: Wheat	Oats	Barley	Years	Market Towns	Description of Grain: Wheat	Oats	Barley
		Brls.	*Brls.*	*Brls.*			*Brls.*	*Brls.*	*Brls.*
1826	Maryborough –	19,000	2,000	—	1831	Maryborough –	22,000	2,040	—
,,	Mountrath –	7,925	6,948	1,700	,,	Mountrath -	10,347	8,148	1,500
,,	Rathdowny –	12,201	—	—	,,	Rathdowny –	17,467	—	—
,,	Abbeyleix –	600	350	—	,,	Abbeyleix -	606	340	—
,,	Carlow Graigue	1,003	6,085	9,749	,,	Carlow Graigue	5,600	10,924	7,484
,,	Stradbally –	450	350	40	,,	Stradbally –	450	350	40
,,	Portarlington –	146	500	100	,,	Portarlington –	152	501	106
,,	Mountmelick –	3,000	2,500	5,000	,,	Mountmelick† –	7,000	8,000	11,000
1827	Maryborough –	19,500	1,800	—	1832	Maryborough –	22,000	2,000	—
,,	Mountrath –	9,590	7,698	1,750	,,	Mountrath –	13,939	7,848	1,500
,,	Rathdowny –	13,835	—	—	,,	Rathdowny –	21,736	691	2,871
,,	Abbeyleix –	600	350	—	,,	Abbeyleix –	680	350	—
,,	Carlow Graigue	6,808	7,133	8,470	,,	Carlow Graigue	11,616	13,274	6,635
,,	Stradbally –	450	350	40	,,	Stradbally –	450	350	40
,,	Portarlington –	146	500	100	,,	Portarlington –	152	501	106
,,	Mountmelick –	4,000	2,000	7,500	,,	Mountmelick –	9,000	11,000	18,000
1828	Maryborough –	18,000	1,900	—	1833	Maryborough –	18,400	2,070	—
,,	Mountrath –	5,103	4,698	1,500	,,	Mountrath –	13,511	7,923	1,500
,,	Rathdowny –	14,143	—	—	,,	Rathdowny –	25,828	1,927	1,048
,,	Abbeyleix –	550	360	—	,,	Abbeyleix –	650	400	—
,,	Carlow Graigue	9,474	8,263	7,099	,,	Carlow Graigue	12,756	12,840	500
,,	Stradbally –	4,500	3,500	400	,,	Stradbally –	450	350	40
,,	Portarlington –	150	505	106	,,	Portarlington –	156	520	107
,,	Mountmelick –	4,000	2,800	8,000	,,	Mountmelick –	11,000	19,600	30,000
1829	Maryborough –	21,000	2,980	—	1834	Maryborough –	21,000	2,080	—
,,	Mountrath –	6,289	5,073	1,550	,,	Mountrath –	14,127	7,098	1,712
,,	Rathdowny –	14,762	—	—	,,	Rathdowny –	25,298	2,083	270
,,	Abbeyleix –	560	360	—	,,	Abbeyleix –	1,100	820	—
,,	Carlow Graigue	6,635	11,540	3,135	,,	Carlow Graigue	13,760	13,038	1,750
,,	Stradbally –	450	350	40	,,	Stradbally –	450	350	40
,,	Portarlington –	150	505	100	,,	Portarlington –	156	520	107
,,	Mountmelick –	4,500	3,500	11,000	,,	Mountmelick –	18,000	21,000	25,000
1830	Maryborough –	22,000	2,000	—	1835	Maryborough –	22,000	2,030	—
,,	Mountrath –	9,907	5,898	2,450	,,	Mountrath –	16,172	7,113	1,700
,,	Rathdowny –	14,228	—	—	,,	Rathdowny –	26,135	2,640	547
,,	Abbeyleix –	560	350	—	,,	Abbeyleix –	1,100	820	—
,,	Carlow Graigue	5,970	11,966	4,412	,,	Carlow Graigue	13,300	15,422	6,100
,,	Stradbally –	450	350	40	,,	Stradbally –	450	350	40
,,	Portarlington –	150	505	106	,,	Portarlington –	156	520	107
,,	Mountmelick* –	5,000	4,000	12,000	,,	Mountmelick –	20,000	30,000	36,000

*Distillery commenced. †Canal opened.

This Return is made from those furnished by the Chief Constables of the County, who prepared theirs from the best sources of information they could obtain on the subject.

Maryborough,
31 March, 1836.

P. Wray, Sub-Inspector.

NOTE.—The location of the foregoing Market Towns may here be indicated with particular reference to surrounding districts.

Counties Offaly and Kildare form respectively the northern and eastern boundaries of Laoighis with the towns of Mountmelick and Portarlington adjacent to the boundary line of the former. The Kildare town of Monasterevan lies east of Portarlington. The towns of Maryboro', Stradbally and Mountrath form, as it were, a triangle midway in the county, surrounded by the Laoighis baronies of Tinnahinch and Portnahinch on the north, Maryboro' and Upperwood on the west, Clarmallagh and Cullenagh on the south, and the baronies of Stradbally and Ballyadams on the east. Carlow Graigue is situated at the extreme south-east of Laoighis immediately adjacent to Carlow County. Tipperary and Kilkenny territories form, respectively, the western and southern boundaries of the barony of Clandonagh in which the market town of Rathdowney is located. Abbeyleix, south of the county, is within the barony of Cullenagh.—R.C.S.

APPENDIX B—(continued)

LAOIGHIS COUNTY.

Return of the Average Prices of Wheat, Barley and Oats, per Imperial Quarter, during the three months from August to December, inclusive, in the years 1833, 1834 and 1835, in the principal market towns in the Queen's County.

Years	Market Towns	Wheat per Imperial Quarter	Barley per Imperial Quarter	Oats per Imperial Quarter
		£ s. d.	£ s. d.	£ s. d.
1833	Maryborough .	2 11 0	—	1 2 0
	Mountrath .	2 4 0	1 4 0	1 2 0
	Rathdowny .	2 4 0	1 2 0	0 17 0
	Abbeyleix .	2 3 0	1 2 0	0 18 0
	Carlow Graigue	2 8 0	1 4 0	0 19 0
	Stradbally .	2 0 0	1 4 0	0 19 0
	Portarlington .	2 4 0	1 10 0	1 4 0
	Mountmelick .	2 7 0	1 5 6	0 17 3
1834	Maryborough .	2 1 0	—	1 2 0
	Mountrath .	2 0 0	1 1 0	1 0 0
	Rathdowny .	2 4 0	1 1 0	0 17 0
	Abbeyleix .	2 4 0	1 2 0	0 17 6
	Carlow Graigue	2 6 0	1 4 6	1 0 0
	Stradbally .	2 0 0	1 4 0	1 0 0
	Portarlington .	2 0 0	1 8 0	1 3 0
	Mountmelick .	1 19 8	1 2 3	0 16 4
1835	Maryborough .	1 17 6	—	1 3 6
	Mountrath .	1 18 2	1 1 0	0 17 0
	Rathdowny .	1 16 0	1 1 0	0 17 6
	Abbeyleix .	1 15 0	1 0 0	0 18 0
	Carlow Graigue	2 2 0	1 4 0	1 0 0
	Stradbally .	2 4 0	1 7 0	0 18 0
	Portarlington .	1 18 0	1 7 0	1 4 0
	Mountmelick .	1 15 4	1 3 6	0 15 9

Prepared as correctly as possible.

Maryborough,
4 April 1836.

W. A. Wray, S.I.

NOTE.—The foregoing account of average prices was also furnished to the Select Committee, and published with its Third Report. Expressed in terms of price per barrel, £1 7s. 8d. was the highest price obtained for wheat, in 1833, at Maryborough; the highest price paid for barley was 16s. at Portarlington, in the same year, and that for oats, in the same town both in 1833 and 1835, was 15s. 3d.

The lowest price paid for wheat was 19s. per barrel at Abbeyleix in 1835; for barley 10s. 8d. in the same town and year, and for oats at Mountmellick 10s. in 1835.

The foregoing prices calculated on the basis of the English quarter of wheat containing 516 lb., that of barley 420 lb. and that of oats 308 lb.—R.C.S.

TABLE 1.

County	Description of Soil	Previous Crop	Date of Sowing	Dates of Ripening: Queen Wilhelmina	Dates of Ripening: Pajbjerg No. 5	Dates of Ripening: Yeoman II x Iron Master	Yield of Grain per Statute Acre: Yeoman II x Iron Master cwts.	qrs.	Pajbjerg No. 5 cwts.	qrs.	Queen Wilhelmina cwts.	qrs.	Incidence of Disease, etc.
CAVAN	Loam	Potatoes	20/10/43	16th August	16th August	16th August	19	3	15	1	18	2	Wilhelmina and Pajbjerg No. 5 slightly attacked by yellow rust.
CLARE, E.	Medium Limestone Loam	Potatoes	27/10/43	16th August	16th August	18th August	24	1	23	2	26	0	None.
CORK, M.	Sandy Loam	Sugar Beet and Potatoes	10/1/44	16th August	16th August	16th August	27	3	27	0	23	2	All varieties slightly affected with mildew.
CORK, S.E.	Limestone Loam	Sugar Beet	5/1/44	14th August	14th August	14th August	24	2	28	1	23	2	Attack of mildew on all varieties.
DONEGAL	Stiff Alluvial Loam	Pasture	21/2/44	12th Sept.	12th Sept.	12th Sept.	25	2	23	3	21	1	Pajbjerg No. 5 attacked by mildew. Some ear blight present in Yeoman II x Iron Master.
DUBLIN, N.	Clay Loam	Potatoes	17/12/43	8th August	8th August	8th August	30	3	34	3	30	3	Yeoman II x Iron Master attacked by yellow rust. Wilhelmina and Pajbjerg No. 5 only slightly.
GALWAY, N.	Limestone Loam	Potatoes	7/2/44	21st August	25th August	26th August	25	3	25	1	23	2	All varieties were free from disease.
KILKENNY, N.	Deep Limestone Loam	Field Peas	15/11/43	24th August	24th August	24th August	24	1	26	2	24	2	All varieties slightly attacked by 'Take All' and yellow rust.
KILDARE, N.	Deep Loam	Sugar Beet	10/11/43	12th August	14th August	14th August	21	2	25	3	28	2	All varieties free from disease.
LEITRIM	Clay Loam	Potatoes	Nov., 1943	Second week in August	Second week in August	Second week in August	20	0	21	2	22	2	Yellow rust prevalent in Wilhelmina and Pajbjerg No. 5. Yeoman II x Iron Master fairly free.
LIMERICK, N.E.	Clay Loam	Roots	15/12/43	19th August	12th August	19th August	22	0	23	3	20	3	All varieties free from disease.
LONGFORD	Medium Loam	Potatoes	26/11/43	14th August	14th August	14th August	23	1	25	0	21	3	All varieties slightly attacked by yellow rust.
LOUTH	Medium Loam	Potatoes	5/11/43	4th Sept.	6th Sept.	4th Sept.	33	0	33	3	28	0	All varieties attacked by yellow rust.
MAYO, S.	Deep Rich Loam	Potatoes	11/2/44	11th Sept.	11th Sept.	11th Sept.	23	3	24	0	22	2	All varieties free from disease.
MONAGHAN, N.	Deep Clay Loam	Potatoes	5/2/44	17th August	17th August	17th August	25	1	24	2	18	1	All varieties severely attacked by "Ear Blight."
OFFALY, N.	Heavy Loam resting on Limestone	Potatoes	18/2/44	24th August	26th August	22nd August	19	1	23	0	17	1	All varieties free from disease.
ROSCOMMON, S.	Medium Loam	Sugar Beet	24/11/43	31st August	6th Sept.	31st August	19	1	16	1	19	2	Do.
SLIGO	Limestone Loam	Potatoes	14/2/44	7th Sept.	5th Sept.	9th Sept.	23	1	20	3	21	3	Do.
TIPPERARY, N.R.	(a) Heavy Clay (b) Loam	Potatoes Mangels	25/11/43 4/12/43	22nd August 23rd August	22nd August 19th August	22nd August 19th August	15 18	3 3	16 22	2 0	14 9	1 3	Do. Do.
TIPPERARY (S.R.) SOUTH	Clay Loam	Turnips	8/2/44	29th August	25th August	25th August	18	3	20	0	20	2	Do.
WATERFORD, W.	Medium Loam	Lea Wheat	17/2/44	24th August	26th August	26th August	16	1	22	0	18	3	Disease negligible
WESTMEATH	Drift Limestone Loam	Sugar Beet	12/11/43	14th August	14th August	14th August	28	1	30	0	19	0	Part of the plot of Queen Wilhelmina was attacked by leather jacket grubs. Treated with Paris Green.
WEXFORD, N.	Deep Medium Loam	Oats	9/11/43	14th August	14th August	14th August	21	3	22	0	18	2	Queen Wilhelmina was attacked by mildew.
WEXFORD, S.	Medium Loam	Potatoes	9/2/44	14th August	14th August	14th August	25	3	26	2	33	0	All varieties free from disease.
				AVERAGE	25 CENTRES	...	23	1	24	2	21	3	

TABLE 2. Potato Variety Trials, 1941: Yields per Statute Acre.

County	Plot No.	Doon Éire			Kerr's Pink			Incidence of Disease, etc.
		Ware	Small	Diseased	Ware	Small	Diseased	
		T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	T. C. Q.	
Carlow	1	5 8 3	0 4 1	3 11 3	9 3 0	0 2 1	3 4 1	Doon Éire tubers abnormally large. Those on top of drill affected with blight.
Cavan	1	5 8 1	0 6 0	7 4 2	10 15 1	1 11 3	3 12 1	Doon Éire tubers badly affected with blight
	2	4 9 0	0 10 0	8 4 2	10 13 3	1 4 0	2 17 0	
	3	7 14 1	0 8 0	7 7 2	12 8 2	0 8 0	1 1 3	Susceptible to black Stalk rot.
Clare	1	7 0 0	0 15 2	2 5 2	9 7 1	1 14 0	0 0 0	Doon Éire inferior to Kerr's Pink in table quality and less resistant to blight.
	2	6 10 0	0 10 0	2 3 1	10 0 0	1 10 0	0 11 2	
	3	10 10 0	1 4 3	2 5 0	9 0 0	1 8 2	2 3 2	Table quality of Doon Éire inferior to Kerr's Pink. Resistance to blight equal in No. 3 experiment. Kerr's Pink superior in No. 4.
	4	8 12 0	1 5 3	2 8 2	9 11 2	1 8 2	0 17 0	
	5	14 0 0	2 17 1	2 8 2	16 8 2	2 11 2	1 0 0	Table quality inferior to Kerr's Pink. Doon Éire less resistant to blight.
	6	4 0 0	0 17 1	6 5 3	10 0 0	2 5 3	3 2 3	
Cork	1	3 2 3	0 11 2	3 14 1	7 2 3	0 11 2	0 5 3	Doon Éire tubers very susceptible to blight
	2	12 15 2	0 17 0	0 0 0	13 12 3	1 11 1	0 0 0	Doon Éire foliage more resistant to blight. No disease.
	3	10 8 2	0 11 2	2 5 3	12 5 3	1 8 2	0 17 0	Doon Éire tubers large and very susceptible to blight.
	4	5 3 2	0 13 0	3 6 0	8 4 2	0 18 2	1 15 0	Doon Éire tubers more susceptible to blight
	5	13 8 3	0 7 0	0 0 0	12 17 1	1 18 2	0 0 1	Crops sprayed *three*
	6	5 14 1	0 9 0	6 17 1	11 8 2	0 14 1	1 0 0	Crops sprayed *twice*. Doon Éire less resistant to blight but more frequent spraying gives effective control.
Donegal	1	6 12 3	0 8 2	1 4 1	8 4 1	1 4 1	0 4 1	At No. 1 centre diseased Doon Éire tubers were affected by blight and soft rot.
	2	10 8 2	0 14 1	0 5 3	12 2 3	0 17 1	0 0 2	
	3	12 4 1	0 7 1	3 7 1	13 5 3	0 12 3	1 8 2	Blight did not appear till August. Kerr's Pink slightly more resistant than Doon Éire.
	4	11 18 2	0 10 0	0 14 1	10 10 0	0 17 1	0 11 2	
Dublin	1	5 12 0	2 13 0	0 9 0	3 2 0	3 13 1	0 0 0	Practically all tops died before blight appeared.
	2	8 8 3	0 10 1	2 14 2	9 12 2	1 3 2	0 12 0	Doon Éire less resistant to blight
Galway	1	6 2 3	0 8 2	5 5 2	8 5 2	0 11 0	0 8 1	Foliage of Doon Éire more resistant to blight but Doon Éire tubers more susceptible. Kerr's Pink better table potato.
	2	7 16 2	0 16 2	4 12 1	9 6 1	1 7 1	2 7 3	
	3	11 2 1	0 15 2	0 7 3	9 3 0	0 16 1	0 4 0	
Kerry	1	9 8 0	0 6 0	2 3 0	11 17 0	0 16 0	0 5 0	Doon Éire less resistant to blight. Large tubers make the variety susceptible to disease. Many seed failures in Doon Éire.
	2	9 6 0	0 9 2	6 7 0	12 14 0	0 18 2	4 0 0	
	3	9 7 0	0 8 0	4 5 0	12 5 2	0 17 0	2 2 2	Some "misses" in Doon Éire [illegible] and higher percentage of diseased tubers. Doon Éire [illegible] very [illegible]
	4	5 14 1	0 10 0	3 13 2	8 5 3	0 14 0	3 0 0	
Kildare	1	8 16 0	0 12 2	1 0 2	6 15 3	2 2 0	0 0 0	Plot No. 1 sprayed twice. The No. 2 [illegible] sprayed. Doon Éire less resistant to blight.
	2	6 11 1	0 12 1	1 2 2	5 4 2	1 17 2	0 13 2	
	3	7 6 1	1 4 1	0 16 1	6 6 0	1 14 3	0 5 2	Doon Éire tubers less resistant to blight.
	4	1 2 0	0 3 5	2 14 3	6 16 3	1 19 0	0 5 0	
Kilkenny	1	5 6 0	0 5 0	1 10 6	6 5 0	0 10 0	0 10 0	Doon Éire stalks more resistant [illegible] than Kerr's Pink. Doon Éire [illegible] of table potato.
	2	9 15 3	1 2 1	2 7 8	10 2 1	2 1 0	1 17 2	Little difference in blight resistance.
Laoighis	1	4 1 0	0 1 2	1 1 2	7 16 1	0 16 0	0 0 2	Doon Éire more susceptible to blight. [illegible] rotted in drill.
	2	6 9 3	0 5 0	1 0 2	10 15 0	0 10 0	0 5 0	Two sprayings at centre No. 2. [illegible] No. 3 Doon Éire very susceptible to blight.
	3	4 5 1	0 15 0	0 12 0	5 17 2	1 2 1	0 4 3	
Leitrim	1	8 10 2	0 17 0	1 0 0	10 6 0	2 0 0	0 5 0	Doon Éire more susceptible to blight. [illegible] table quality poor.
Limerick	1	9 7 0	1 10 0	0 7 0	8 0 0	1 12 0	0 5 0	Doon Éire more resistant to blight.
	2	0 16 2	1 2 0	4 3 0	6 8 2	2 8 0	3 8 1	Incidence of blight low. Little difference between the two varieties.
	3	10 2 0	0 6 3	0 12 0	3 9 0	2 0 1	0 12 0	
Longford	1	1 10 0	0 12 3	2 10 0	7 0 0	1 0 0	1 10 0	Both varieties very resistant to blight. Kerr's [illegible]
	2	4 12 0	0 8 0	2 10 0	5 5 0	1 15 0	0 11 0	Some misses in Doon Éire. Large tubers [illegible] disease.
Louth	1	7 15 0	0 3 2	2 10 0	9 12 0	0 7 1	0 11 2	Doon Éire poor resistance to blight. Starch content equal
Mayo	1	5 6 2	0 10 2	3 5 0	6 19 2	0 15 0	0 11 0	Kerr's Pink greater resistance to blight.
	2	7 1 2	0 15 0	5 8 2	8 18 0	0 19 2	1 2 0	Plots well sprayed. Doon Éire tubers very susceptible to blight.
Meath	1	8 8 0	1 4 0	2 0 2	12 8 0	1 3 2	2 8 3	More discarded tubers in Kerr's Pink.
	2	7 7 2	0 8 3	1 2 2	6 0 1	0 8 0	0 5 2	Kerr's Pink greater blight resistance
Monaghan	1	4 18 0	1 4 0	6 17 0	8 8 0	4 0 0	1 19 6	Doon Éire poor resistance to blight. Inferior table quality.
	2	8 3 3	2 13 1	3 13 0	11 11 2	2 14 2	1 6 0	
	3	10 5 8	0 12 3	0 17 1	11 17 1	1 14 1	0 5 3	
	4	11 7 1	0 12 3	2 7 1	10 17 1	2 8 2	1 0 0	
Offaly	1	9 19 1	1 14 2	2 7 3	6 1 1	5 15 0	0 5 2	Doon Éire is very susceptible to blight attack
	2	7 4 0	0 16 1	2 8 0	9 12 2	1 11 3	0 4 0	
Roscommon	1	6 9 1	0 5 2	3 9 0	8 12 3	1 14 2	0 7 1	In Experiment No. 1 both tubers and foliage of Doon Éire were very susceptible to blight. Many misses through cutting seed. In Experiment No. 2, stalks equally free but tubers badly affected with blight
	2	2 15 0	1 13 0	2 0 1	7 0 0	1 13 1	0 4 0	
Sligo	1	11 12 0	0 19 0	1 12 0	8 12 0	0 17 0	0 12 0	Doon Éire stalks more resistant to blight but tubers susceptible.
Tipperary (N.R.) ...	1	7 13 2	0 9 2	1 8 0	8 16 0	0 12 0	0 7 0	Doon Éire more susceptible to blight. Table quality poor.
	2	7 1 1	0 18 2	1 0 1	8 17 3	1 2 0	0 6 1	Doon Éire tubers very susceptible to blight.
Tipperary (S.R.) ...	1	8 12 3	1 11 1	0 2 3	9 11 1	0 8 2	0 5 3	No difference as to blight resistance between two varieties.
	2	10 13 0	0 3 0	0 0 0	8 8 0	0 16 2	0 1 2	No difference between foliage of the two varieties. No diseased Doon Éire tubers.
Waterford	1	6 17 0	0 5 2	3 3 0	7 8 2	0 14 0	1 0 0	No apparent difference in blight-resisting qualities as to foliage. Doon Éire tubers very much affected.
	2	4 11 2	0 3 0	5 2 3	7 11 1	0 12 0	1 0 2	
	3	14 0 0	1 0 0	0 0 0	8 10 0	1 0 0	0 0 0	Doon Éire stalks slightly more resistant to blight.
Westmeath	1	8 4 0	0 2 2	1 0 0	9 13 0	1 2 0	0 1 1	Doon Éire very susceptible to blight, particularly the tubers.
	2	4 10 0	0 3 1	4 10 0	8 2 0	2 2 0	2 11 0	
Wexford	1	3 11 0	0 5 0	4 2 0	7 15 0	1 3 0	0 8 0	Doon Éire much more susceptible to blight.
	2	7 6 0	0 6 0	4 3 0	9 0 0	0 14 1	1 3 0	
Wicklow	1	8 16 2	1 2 1	1 2 0	8 10 2	1 0 3	0 15 2	Doon Éire stalks resisted blight infection better than Kerr's Pink, but the tubers were more heavily infected.
	2	9 4 3	1 1 3	1 6 1	9 8 2	1 6 0	1 1 2	
	3	9 19 0	0 1 0	4 10 0	9 11 0	1 10 0	0 8 0	
	4	11 7 1	0 0 0	2 15 0	11 0 0	1 0 0	0 10 0	
Average (73 Centres) ...		7 14 2	0 11 1	2 14 0	9 4 2	1 7 0	0 19 1	

FIELD EXPERIMENTS, 1944.

Experiments conducted by County Agricultural Instructors in 1944 included wheat and potato trials with the same varieties as were compared in the 1943 season. The results of the trials in the latter season were published in Vol. XLI. No. 2.

WHEAT VARIETY TRIALS.

The varieties included in the wheat trials were Queen Wilhelmina, Pajbjerg and Yeoman II x Iron Master.

Trials were conducted at thirty centres in twenty-six counties. Particulars of soil, dates of sowing and reaping, yields and incidence of disease for the three varieties at twenty-five centres are contained in Table 1. At three centres the crops failed due to (*a*) leather jacket grub, (*b*) birds, (*c*) adverse soil and weather conditions. At the Co. Carlow centre weather conditions at harvesting were so unfavourable that although satisfactory crops had been reaped it was impossible to get the grain dried for threshing till it was badly damaged and weighings were not taken. In County Louth rooks and wood-pidgeons caused considerable damage to the plot of Queen Wilhelmina which resulted in the poor yield of grain recorded. At the Laoighis centre Yeoman II x Iron Master brairded very thinly and as no apparent improvement was noticed in spring the plot was over-sown with Atle which yielded at the rate of 13 cwts. 2 qrs. per statute acre.

At the great majority of the centres Queen Wilhelmina produced a longer and a slightly weaker straw than either of the other varieties and lodged badly at one centre and slightly at two others. None of the other varieties lodged at any centre.

The quality of the grain was generally good except in Co. Monaghan where all the varieties were attacked by "ear blight", the grain produced being of poor quality and badly filled.

As in previous trials the Pajbjerg selection gave the heaviest average yield of grain, 24½ cwts. per acre, *i.e.*, 1¼ cwt. more than Yeoman II x Iron Master and 2¾ cwt. more than Queen Wilhelmina per statute acre.

POTATO VARIETY TRIALS

Trials to compare the yielding and blight-resisting qualities of the recently introduced variety, Doon Éire, with those of Kerr's Pink were carried out at seventy-three centres in all counties. Particulars of yield of ware, small, and diseased grades for both varieties together with notes as to incidence of disease are contained in Table 2. As indicated therein Kerr's Pink gave an average yield of 30 cwt. of ware grade per acre more than Doon Eire though the average of the total yield was only 8 cwt. per acre more for Kerr's Pink than for Doon Éire. The reports indicated that at most centres the tubers of Doon Éire grew very large, were frequently near the surface of the soil or partly uncovered with the result that a considerable proportion of them were blighted thus giving an undue weight of blighted tubers in this variety. Except at three or four centres Doon Éire was stated to be very susceptible, or less resistant to blight than Kerr's Pink. At a few centres it was considered that while the foliage of Doon Éire showed equal or even better resistance to blight than that of Kerr's Pink the tubers of Doon Éire were much less resistant. At eleven centres from which reports on table quality were received Doon Éire was considered to be of inferior quality.

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